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IMPROVED ANTIGEN FOR THE SLIDE TEST FOR TRICHINOSIS*

HAZEL SUESSENGUTH, B. S., M. T.†

Since the publication in 1944 of "A Simple Rapid Flocculation Slide Test For Trichinosis In Man And In Swine,"[1] a method of preparing a specific antigen far superior in sensitivity and stability to the original one has been developed. With the improved antigen, positive reactions have been obtained in experimentally infested swine as early as the 8th day after infestation (as contrasted with the 14th to 17th day originally) and for at least 903 days (as contrasted with 322 days, at most, in the original study). With the improved antigen the highest titer‡ in man was 1:4096 (as contrasted with 1:128 in the original study) and in swine 1:128 (as contrasted with 1:64 in the original study).

Changes have been made in the manner of drying trichinae larvae and in the method of use of the dried larvae in the preparation of the emulsion for the slide test for trichinosis. Variation in results of different lots of antigen emulsion has been practically eliminated by the use of the improved antigen.

The original work on the slide test for trichinosis in man and in swine was carried out on two lots of trichinae larvae. The larvae were dried by desiccation and then powdered. An alkaline extract was made of the powdered larvae and this was freed of worm material before use in the preparation of the antigen emulsion. Subsequent lots of larvae showed slight to considerable variation in both sensitivity and specificity so that a method was sought for stabilizing the antigen and the antigen emulsion. Instead of using ordinary desiccation methods, the larvae were dried by desiccation from the frozen state (lyophilization) as suggested by McNaught[2] and the larvae used whole instead of in the powdered form. The preparation of an alkaline extract

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‡ Titer: Last dilution of serum in which there is a positive reaction (± to ++++).

of the whole lyophilized larvae and the immediate use of extract and larvae in the preparation of antigen emulsion not only corrected the variations of different lots of emulsion but also resulted in a greater sensitivity than obtained with emulsions of the original type.

Following the first positive reaction in experimentally infested swine (8 days) with the improved antigen, the titer in swine reached a peak of 1:128 in 19 to 30 days as contrasted with 1:64 in 23 to 55 days with the original antigen. The decline in antibody content in swine is a very gradual one. With the improved antigen, 3 infested hogs still show a titer of 1:32 two and one half years after infestation.

The earliest positive reaction in man appears to be about the 21st day as in the original study. (In most cases it is impossible to obtain an accurate history of the day the infested meat was eaten.) However, the greater sensitivity of the improved antigen in tests of human sera has been reflected in an increased titer. In the average case of 3 to 4 weeks duration the titer is 1:64 as contrasted with 1:16 in the original study. One case reached a peak of 1:4096 in 2½ months.

Preparation of the Larvae

Trichina larvae are obtained in the usual manner by infecting rats§ with trichinous meat and sacrificing the animals 4 to 6 weeks after infestation. The rats are skinned and eviscerated and the remainder of the carcass is ground in the meat grinder. The ground trichinous meat is then ready for digestion.

As stated by Bozicevich,[3] "Hobmaier and Meyer have described a modification of the Baermann appartus for the recovery of trichina larvae. For this purpose, the author prefers a funnel of 3-liter capacity, to the stem of which a centrifuge tube is attached by means of a short piece of rubber tubing. A pinchcock is placed on the tubing to permit closing when the centrifuge tube containing the larvae is removed after digestion of the infested meat. A 6-inch perforated porcelain plate, such as is used in a desiccator, is placed in the funnel, and over this plate are laid 4 or 5 layers of cheesecloth having 40 to 44 mesh apertures to the inch.

"The digestive fluid is prepared by adding 15 grams of pepsin to 3 liters of warm tap water; this amount is sufficient to digest approximately 70 grams of infested meat. The mixture is stirred until the pepsin dissolves and then 21 cc. of HCl (specific gravity 1.10-1.19) are added. The digestive fluid is placed in the modified Baermann apparatus. The meat is added carefully, without agitation, on top of the cheesecloth. The funnel containing these

§ For obtaining large quantities of larvae it is advisable to infest larger animals (rabbits or swine).

materials is placed in an incubator at 37 degrees C. for a period of 15 to 18 hours. As the larvae are liberated from their cysts by the digestive fluid, they gravitate to the bottom of the centrifuge tube, and, by means of their constant agitation, set in motion the fine sediment which settles over them when they become static. As a result, a clean concentrated collection of larvae may be obtained, thus necessitating only a minimum amount of manipulation in removing rat protein.

"At the termination of the incubation period, the pinch-cock on the rubber tubing is closed and the centrifuge tube removed. The supernatant fluid, along with the layer of sediment, is removed by means of a pipette. In order to neutralize the acid adsorbed from the digestive fluid, a washing solution of a pH 7.5 is used." From this point on, slight changes in the Bozicevich method of washing are made. The centrifuge tube is filled with the washing solution (distilled water brought to pH 7.5 with sodium bicarbonate), inverted gently several times and allowed to stand until all the larvae settle in the tube; the supernatant fluid is then carefully decanted. The larvae are washed eight times in this manner. After the eighth washing a biuret test is made on the supernatant fluid and, if negative, the larvae are ready to be dried by lyophilization.

The wet larvae are placed in about 2 cc. quantities in pyrex test tubes and the excess fluid removed. Larvae may be kept in deep freeze (—25 degrees C.) for a few weeks for convenience or may be lyophilized immediately. After lyophilization, the tubes are sealed in vacuo or stoppered and sealed so that no moisture enters the tube. The whole lyophilized larvae may be kept in the refrigerator for an indefinite period of time. Excessive handling of the dried larvae is to be avoided to prevent breaking them.

Preparation of the Trichina Antigen

1. 40 mg. whole lyophilized larvae are placed in a test tube (about 14 mm. diameter).
2. 0.8 cc. of freshly prepared 0.1% sodium carbonate solution is added.
3. Gently shake the tube and place in a 37-degree C. water bath for 30 minutes. At five-minute intervals the tube is gently shaken.
4. At the end of 30 minutes the antigen (mixture in the tube) is **immediately** used in the preparation of the antigen emulsion.

Preparation of the Antigen Emulsion for the Slide Test for Trichinosis.

1. Into a 1 oz. glass stoppered bottle, pipet 0.85 cc. of distilled water.

2. The bottle is held at an angle and, pipeting with the left hand, 1.0 cc. of 1% cholesterol (Pfanstiehl C. P. precipitated from alcohol for Kline tests) solution in absolute alcohol is allowed to fall drop by drop into the bottle. At the same time the bottle is shaken vigorously with the right hand.
3. The bottle is gently rotated on a flat surface for 20 seconds.
4. Insert a 1 cc. serological pipet into the antigen tube and **gently** mix the antigen by drawing it up twice in the pipet. Then pipet 0.6 cc. of the antigen into the bottle.
5. The bottle is then stoppered and shaken vigorously for 1 minute (the fluid thrown from the bottom to stopper and back).
6. 2.0 cc. of 0.85 percent sodium chloride solution is allowed to run into the bottle quite rapidly, the bottle is again stoppered and shaken less vigorously than previously for 1 minute.
7. The emulsion is poured into a test tube and allowed to stand about ½ hour. During this time practically all the larvae settle to the bottom of the tube. The antigen emulsion is then decanted into another test tube and the larvae discarded.
8. The tube of antigen emulsion is corked and placed in the refrigerator overnight.
9. The emulsion is then ready for use and retains a satisfactory sensitivity and specificity for 6 weeks if the tube is kept tightly stoppered and refrigerated.
10. Immediately before use the tube of emulsion is shaken vigorously back and forth for 1 minute.

Technic of the Test

1. Whole blood is collected in a test tube, allowed to clot, then centrifuged and the serum poured into a clean tube. The serum to be tested is heated at 56 degrees C. for 30 minutes or at 61 degrees C. to 63 degrees C. for 4 minutes.
2. Pipet 0.05 cc. serum into the chamber of a paraffin ringed slide as for the slide test for syphilis (12 sera may be tested at one time).
3. One small drop of the emulsion is allowed to fall from a Wright pipet into the serum. (A 26 gauge needle with a syringe may be used for dropping the emulsion.)
4. The slide is rotated on a flat surface for 4 minutes. The rotation should describe a circle ¾ inch in diameter and should be at the rate of 150 per minute. (A faster rotation reduces the sensitivity of the test.)
5. The results are examined at once through the microscope at a magnification of 100 times (low power 16 mm. objective; 10 x eyepiece) with the light cut down as for the study of

urinary sediments and reported in terms of pluses according to the degree of clumping and the size of the clumps. In negative reactions, the coated crystals are completely dispersed and there is no clumping whatever.

6. In performing tests on hog sera it has recently been found that maximum sensitivity is obtained only when the tests are done at 37 degrees to 40 degrees C. This may be accomplished by rotating the slides on the flat metal top of a water bath at 37 degrees or by rotating the slides 6 inches under a 100 watt lamp.

Results in Man of the Flocculation Slide Test for Trichinosis*

CASES GIVING POSITIVE REACTION (TOTAL 200)

1. 147 of 407 suspected cases.
   a. 16 with positive biopsy (one of these complicated tuberculous peritonitis).
   b. 2 in which biopsies were not done but larvae were found in the meat.
   c. 12 of the cases were previously negative (too early after infestation).
   d. 7 with negative biopsies. (1 false positive slide test in case of lupus erythematosis disseminatus; 1 case negative when retested 1 month later, false positive?).
2. 52 of 3460 (1.5%) routine hospital and ambulatory cases for routine serology.
   a. 3 with positive biopsies (2 of these complicated diabetes mellitus, 1 gall bladder disease).
3. 1 clinically negative case. Negative biopsy (false positive?).

CASES GIVING NEGATIVE REACTIONS (TOTAL 3700)

1. 3408 hospital and ambulatory cases for routine serology in which over 140 were cases of syphilis with positive blood tests for that disease.
2. 24 cases of parasitic infestation other than trichinosis.†
3. 260 of 407 suspected cases, negative biopsy in 2 cases.
4. 7 cases clinically positive 1½ to 4 years previously. Three with positive flocculation tests earlier.
5. 1 case clinically positive (about 4 weeks after infestation). Parasites found in stool earlier. (false negative test?).

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* Results include those of the original work in addition to those with the improved antigen.

† 1 ascaris lumbricoides, 1 echinococcus, 3 malaria, 7 endaemoeba histolytica, 10 (filaria and schistosoma), 1 diphyllobothrium latum, 1 trichuris trichiura.

TABLE 1.
COMPARISON OF THE FLOCCULATION TEST WITH OTHER TESTS FOR THE DIAGNOSIS OF TRICHINOSIS.
1. BIOPSY.

(A) Cases with Positive Flocculation Slide Tests

BIOPSY

Positive	Negative	Total Cases
19	8*	27**

* 1 gave a negative skin test, 42% eosinophiles.
2 gave a positive skin test, 61%–69% eosinophiles.
2 showed myositis.
1 had 47% eosinophiles.
1 negative slide test 1 month later (false positive?).
1 diagnosed as lupus erythematosis disseminatus (false positive).
** additional cases biopsy not done but larvae found in meat.

(B) Cases with Negative Flocculation Tests

BIOPSY

Positive	Negative	Total Cases
0	2	2

2. SKIN TESTS.

(A) Cases with Positive Flocculation Slide Tests

SKIN TEST

Positive	Negative	Total Cases
10	10*	20

* 2 cases with positive biopsies.

(B) Cases with Negative Flocculation Slide Tests

SKIN TEST

Positive	Negative	Total Cases
3*	2	5

* 1 slide tested 3 years after infestation.

3. PRECIPITIN TEST.

(A) Cases with Positive Flocculation Slide Tests

PRECIPITIN TEST

Positive	Negative	Total Cases
1	1*	2

* biopsy positive.

(B) Cases with Negative Flocculation Slide Test

PRECIPITIN TEST

Positive	Negative	Total Cases
1*	0	1

* Suspected during an epidemic and slide tested 6 to 8 weeks later. Eosinophile count 0% at time of suspected infestation.

4. EOSINOPHILIA.

(A) Cases with Positive Flocculation Slide Tests

PERCENT EOSINOPHILES

0–3	4–10	11–30	31–80	Total Cases
2	7*	43	38	90

* 2 cases examined several months after infestation.

(B) Cases with Negative Flocculation Slide Tests

PERCENT EOSINOPHILES

0–3	4–10	11–30	31–80	Total Cases
8	8	7	11	34*

* 7 in suspected cases.

Experimental Trichinosis in Swine

In a previous report[1] the results of the flocculation slide test in 11 infested pigs were given in great detail. At the end of 10 months, the reaction was still not negative. These pigs were tested until the reactions were repeatedly negative with the original type antigen emulsion. Subsequently 12 pigs were infested with trichinae to determine the earliest and latest reaction obtainable with the improved antigen.

The earliest first positive reaction with the original antigen in the first set of 12 pigs was the 14th to 17th day. Of the 12 pigs in the later experiement, one died 6 days after infestation when the reaction was still negative. Of the remaining eleven pigs the earliest first positive reaction with the improved antigen was 8 days after infestation.

Of the first group of eleven pigs, the last positive reaction with the original type antigen was obtained the 221st to 301st day after infestation; the first negative reaction, the 257th to 322nd day after infestation. Of the second group of eleven pigs, seven were used for harvesting larvae and three are being kept to determine the day of the last positive reaction with the improved antigen. All three pigs still show a strongly positive reaction 903 days after infestation.

In order to determine whether the dose of larvae for infestation affects the time of the appearance of the first positive reaction, two pigs were given 80 grams and one pig 8 grams of infested rat meat. All pigs were tested the 10th day after infestation and all showed a strongly positive reaction with the titer of the reactions in the pigs fed 80 grams of meat 1:8 and 1:4 respectively and that of the pig fed 8 grams of meat 1:2. This would seem to indicate that the dose of larvae, beyond a certain minimum, has little influence on the antibody response.

Results in Swine of the Flocculation Slide Test for Trichinosis

ANIMALS GIVING POSITIVE REACTIONS (TOTAL 34)

1. 12 of 379 tests done on abattoir hogs. Trichinae found in the diaphragm of one. No microscopic examination made of others.
   a. 1 of 197 (using original antigen).
   b. 11 of 182 (using improved antigen).
2. 22 pigs in which trichinosis was experimentally produced first gave reactions in the flocculation test as shown in table 2.

ANIMALS GIVING NEGATIVE REACTIONS (TOTAL 391)

1. 367 of 379 tests done on unselected abattoir hogs.
   a. 196 of 197 (using original antigen).
   b. 171 of 182 (using improved antigen).
2. 24 pigs before experimental infestation with trichinae.

a. 8 pigs not tested between time of infestation and appearance of first positive reactions.
b. 1 not tested between time of infestation and its death in 6 days.
c. 15 pigs gave negative reactions after infestation as shown in table 2.

TABLE 2.

Number of Pigs	Negative Reactions After Infestation	First Reaction (± to++++) After Infestation
3	3rd, 4th, 7th day	8th day*
5	(not tested between day of infestation and 10th day)	10th day*
1	(not tested between day of infestation and 12th day)	12th day*
2	(not tested between day of infestation and 14th day)	14th day*
1	13th day	17th day
3	13th, 17th, 19th day	21st day
3	13th, 17th, 19th, 21st day	23rd day
1	15th, 19th, 21st day	23rd day
1	13th, 17th, 19th, 21st, 23rd day	25th day
1	6th, 13th, 20th day	27th day
1	2nd, 5th, 7th, 9th, 12th, 16th, 18th, 21st day	27th day
1	2nd, 5th, 7th, 9th, 12th, 16th (died 16th day)	.....
Total 23		

* Tested with improved antigen.

Discussion

The most commonly used laboratory procedures for the diagnosis of trichinosis are: (1) examination of stool for adult worms, (2) examination of blood for larvae, (3) biopsy, (4) eosinophile count, (5) precipitin tests, and (6) skin tests. None of these procedures is highly reliable. Rarely are the worms found in the stool[4,5] or the larvae in the blood;[5] as is now well known, an elevated eosinophile count may accompany a number of diverse pathological conditions. While a positive biopsy is definitely diagnostic of trichinosis a negative biopsy does not exclude it.[6] The results of a number of investigators[7,8,9,10] indicate that the precipitin tests are of low sensitivity and specificity in human sera and are unreliable in hog sera. Reports[7,11,12] indicate the skin test to be dependable in, at most, 90 per cent of cases. The limited experience with these tests, given above, corroborates the general impression of their value. (See Table 1.)

Since the commonly used laboratory methods for the diagnosis of trichinosis are of doubtful dependability or are difficult to

perform, there is need for a simple reliable diagnostic procedure. The simple rapid flocculation test with improved antigen described above has been found to be more reliable in the diagnosis of trichinosis than the other tests. (See Table 1.)

A number of investigators[6, 13, 14, 15] have found that 16% to 24% of the general population is infested with trichinae larvae and 4.5% have enough larvae to cause pronounced clinical symptoms.[14] Yet trichinosis is a preventable disease since adequate heating of pork, or the eradication of trichinae from hogs would eliminate trichinosis from human beings. Gould[16] has summarized methods for the control of trichinosis as follows: "(1) destruction of rats, (2) elimination of garbage from feed, (3) cooking garbage, (4) microscopic inspection of pork, (5) processing pork products customarily eaten raw, and (6) education of the public to cook pork."

In a trial examination at a local abattoir, 40 hogs were marked by number and tested (with the original type antigen). One hog gave a positive reaction for trichinosis and a press examination of its diaphragm showed many typical coiled larvae. This small experiment indicates that since trichinosis in man ordinarily results from the ingestion of infested pork and since the average life span of swine fed for market is about one year and antibodies to trichinae are detectable by the flocculation slide test with improved antigen for as long as two years after infestation, better prevention of trichinosis in man than thus far achieved can probably be accomplished by the routine use of this simple test on hogs at the time of slaughter and by the proper disposal of the animals giving a positive reaction.

The following note was included in the first article on the flocculation slide test for trichinosis[1] "It was found by one of us (H.S.) that an alkaline aqueous extract of powdered trichinae larvae possesses the property of coating cholesterin crystals and of acting as specific and sensitive antigen in the simple rapid flocculation slide test for trichinosis. This observation suggests the possibility that extracts of other injurious agents may behave similarly and permit the preparation of specific and sensitive antigen emulsions for flocculation tests for the detection of the diseases they produce." Since then, the method has been successfully applied to the preparation of antigen emulsion for the diagnosis of schistosomiasis by Brandt and Finch.[17]

Summary

An improved antigen for use in the slide test for trichinosis in man and in swine is described above.

Larvae are dried by lyophilization, an alkaline extract of whole

lyophilized larvae is made and used immediately in the preparation of the antigen emulsion for the slide test.

The use of improved antigen not only stabilizes the tests so that there is practically no variation between different lots of antigen emulsion but also results in a very high sensitivity with no loss in specificity.

With the improved antigen, positive reactions were obtained in swine as early as the 8th day (as contrasted with the 14th to 17th day in the original study) and for at least 903 days after infestation (as contrasted with 322 days, at most, in the original study).

Better prevention of trichinosis in man than thus far achieved can probably be accomplished by the routine use of this simple test on hogs at the time of slaughter and by the proper disposal of the animals giving a positive reaction. The collection of the blood requires no modification of the present routine in abattoirs and the testing of a considerable number of samples can be done by one technologist in a matter of minutes.

It was lately found and reported[1] that an alkaline aqueous extract of trichinae larvae possesses the property of coating cholesterin crystals and of acting as a specific and sensitive antigen in the simple rapid flocculation slide test for trichinosis. This observation suggests the possibility that extracts of other injurious agents may behave similarly and permit the preparation of specific and sensitive antigen emulsions for flocculation tests for the detection of the diseases they produce. The method has been successfully used by Brandt and Finch in the preparation of antigen emulsion for the diagnosis of schistosomiasis.

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IDENTIFICATION OF MONILIA SPECIES*

RUTH Y. MAYNE, M. S., M. T.

Diseases caused by fungi have been studied more intensively in recent years than they have been previously because of the growing awareness and interest of clinicians in the laboratory findings. However, since a number of fungi are found in normal persons, their mere presence does not convict them as the etiologic agent of disease. For example, pathogenic and saprophytic yeasts have been found in vaginas, on skin, on oral mucous membranes, and in stools of normal healthy persons.

Certain predisposing factors have been observed in diseases produced by yeast-like organisms: oral thrush is prone to occur in infants and in elderly people with wasting diseases, lesions of the hands occur frequently in persons working in water, and monilial vaginitis is often found in diabetics and in pregnant women.[1] Jones and Martin[2] in 1938 isolated yeast-like fungi from 32 per cent of their obstetric patients but from only 14 per cent of their gynecologic patients. In another survey two years later, Carter et al.[3] found that cultures for yeasts were positive in 43 per cent of their pregnant cases.

In the same study a correlation was made between the various genera and species and their pathogenicity. It was noted that fungi belonging to the genera Saccharomyces and Cryptococcus were not associated with symptoms, and that those patients from whom the species *Candida albicans*, *C. stellatoidea*, and *C. tropicalis* were isolated were the only ones having leukorrhea and pruritus.

This vaginitis is very difficult to cure before delivery. After that time it usually disappears without treatment because the cells lining the vaginal mucosa lose their increased glycogen content and revert to normal. The condition, although not serious, is very annoying to the patient. Moreover, the best specific yet found, gentian violet, is messy to use and occasionally is irritating to the mucous membranes. Consequently many studies have been made evaluating treatments. A few workers, like Carter, have approached the problem in a true scientific way by trying to identify the etiologic agents and studying their properties.

Thus we see there is a growing call for the identification of monilial species. There is great confusion in the classification,

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because many cultural methods and synonyms for the same species have been used in the past. For purposes of orientation, the major divisions of yeast-like organisms will be briefly reviewed here. Yeasts are large, budding cells which take the Gram's stain and on culture, unlike most other fungi, never produce a fuzzy growth of hyphae above the medium. Members of the first group, the true yeasts, develop sexual spores or ascospores within the cell when conditions are unfavorable to growth, but they do not form mycelia within the medium. The second group, the Cryptococci or false yeasts, forms neither ascospores nor mycelia. Monilia, the third group, have pseudomycelia, but no ascospores are produced. The genus name for monilia is now accepted as Candida.

Although the method of identification devised by Martin and his associates[4] has been criticized by many mycologists, it still seems the simplest and the most dependable one for the bacteriologist. It is employed at Tulane University, Department of Gynecology, to study monilia from the vagina and will be described here.

Material from the walls of the vagina is smeared upon the surface of a tube of Sabouraud's dextrose agar, which is incubated at room temperature for three to four days. Opaque, white or cream colored colonies are smeared and stained with Gram's stain, and if found to be yeasts, are inoculated into Sabouraud's broth. The tube of broth is incubated at 37° C. for forty-eight hours and observed for surface film. The broth tube is then shaken to suspend the growth, and a loopful of culture is streaked on a beef-extract, ten per cent blood agar plate which is incubated at 37° C. for ten days. A description of the colonies is recorded, and a typical, well isolated colony is picked to another Sabouraud's agar slant. This not only provides ample growth with which to work, but also insures that a pure culture is being studied. If the blood agar plate shows two kinds of colonies, or is contaminated with bacteria, cultures should be made from the plate to other broth tubes, since the previous film formation will not have been characteristic. The forty-eight hour growth from the second Sabouraud's slant is planted on a sterile carrot plug and on a tube of sugar-free beef-extract agar. Both are incubated at room temperature. The carrot is examined by wet mount or spore stain at intervals over a period of at least two months for ascospores. The growth from the beef-extract tube is transplanted to another beef-extract tube after forty-eight hours. At least two, and preferably three, beef-extract tubes should be planted successively to eliminate traces of sugar before fermentation and corn-meal agar studies are made. A loopful of growth from the last beef-extract tube is streaked

across the surface of a drop of corn-meal agar which has been allowed to solidify on a sterile slide. The slide is incubated about one week at room temperature in a sterile petrie dish with a piece of sterile cotton which is kept moist. The rest of the growth is suspended in saline and inoculated into four tubes of beef-extract broth tubes containing gas tubes, an indicator of brom-thymol-blue, and one per cent of filtered glucose, sucrose, lactose, and maltose respectively. The inoculated medium is overlaid with sterile paraffin oil to obtain a moderate amount of anaerobiasis and incubated ten days at 37° C. The corn-meal slide culture is stained in lacto-phenol cotton blue, decolorized in 70 per cent alcohol, dehydrated in progressively stronger changes of alcohol, acetone, and zylol, and fitted with a coverslip.

There are six species which can be differentiated by this method. *Candida albicans* has no film in broth and forms one to two millimeter round, dull-gray colonies on blood agar. It produces acid and gas in glucose and maltose, and acid in sucrose. On corn-meal agar it forms well defined, branching mycelia with budding blastospores and chlamydospores. The latter are very large, thick walled cells which stain intensely with cotton blue.

Candida stellatoidea has no film in broth. On blood agar it develops colonies which have little arm-like projections extending out on the surface of the medium giving the appearance of a star. This star-like form suggested the name "stellatoidea." It gives rise to acid and gas in glucose and maltose, but does not ferment the other two sugars. On corn-meal agar it produces branched mycelia with large, ball-like clusters of blastospores.

Candida krusei forms a thin film on the surface of Sabouraud's broth; this film climbs up the side of the tube as high as one centimeter. The colonies are very small on blood agar. Krusei ferments glucose with acid and gas. On corn-meal, the mycelia look like crossed sticks, and no chlamydospores are produced.

Candida tropicalis forms a film which is broken by gas bubbles and which does not grow high along the sides of the tube. The colonies on blood agar are large and gray and are surrounded by a mycelial fringe. Well developed mycelia and blastospores occur on corn-meal agar. Tropicalis, being the most vigorous fermentative agent in the group, produces acid and gas in glucose, maltose, and sucrose.

Candida pseudotropicalis is not particularly characteristic on any of the media. It forms no pellicle, has small colonies on blood agar, and has poorly developed mycelia and no chlamydospores on corn-meal. However it ferments glucose and lactose with acid and gas.

The last species, *C. parakrusei*, has no film on broth. The colonies on blood agar are small and brilliantly white. On corn-meal,

CARROT PLUG
10% BLOOD BEEF EXTRACT AGAR
AGAR
BROTH
SABOURAUD'S
AGAR
BEEF EXTRACT AGAR
CORN MEAL EXTRACT
DEXTROSE LACTOSE SUCROSE MALTOSE
BROTHS

mycelia are well developed when present, but often none are found. This species, being the least fermentative of the group, produces acid and gas in glucose only; occasionally gas does not appear. It will be noted that *C. krusei* and *C. parakrusei* have the same reactions in the carbohydrates; however these species are easily differentiated by their growth in Sabouraud's broth and on blood agar.

Since some species do not form myeclia well on the corn-meal agar, the Sabouraud's broth is kept for five or six days, and then a wet mount is examined for mycelia. This is the easiest way to differentiate false yeasts from parakrusei and pseudotropicalis.

As has already been mentioned, the Martin method is considered by some workers as being complicated and long for the busy laboratory. This is quite true, but there are a few short cuts. A preliminary report may be made for *C. krusei* and *C. tropicalis* which form typical surface film on Sabouraud's broth, for the typical stellatoidea which forms stars on blood agar, and for *C. albicans* with its chlamydospores on corn-meal agar. All of the procedures must be carried out before even a preliminary identification can be reached for the last two species, but these are found less often than the other four. All procedures must be carried out for a final report. That is important because after the results of all media are noted, occasionally the picture is not typical, and some of the tests must be verified. At times albicans has small outgrowths on blood agar which have led to the recording of star formation, sometimes the reaction in sucrose is negative but a check shows acid formation, and often there is no formation of mycelia or chlamydospores on corn-meal agar.

These variations may be explained by one or both of two facts: a) differences in technique, particularly in the case of corn-meal and fermentative tests, call forth different reactions, and b) slight or temporary dissociation of the culture causes variable results. Many atypical and dissociated strains were found by Martin and Jones[5] and Mickle and Jones[6] when they studied stock strains of monilia which had been carried for years in various laboratories. When these cultures were subjected to a series of replatings and several colony selections, smooth colonies were obtained which corresponded with one of the six species mentioned above. This fact probably explains some of the synonyms and the many new species which have been reported in the literature.

No rabbit pathogenicity tests have been made in the series at Tulane because of the large numbers of cultures and the correspondingly large sums of money which would be necessary to obtain animals. It is agreed in the literature that *C. albicans* is is the only species which is pathogenic to the rabbit. However it

has been found that four cases of mycotic endocarditis were caused by *C. parakrusei*[1] and that at least three species of Candida cause monilial vaginitis.[3] Also, *C. albicans*, pathogenic to rabbits, has been found in many apparently normal individuals. From these facts it appears that the death or lack of death of a rabbit inoculated with a strain of monilia does not necessarily correspond with disease in a human being.

It must be emphasized that if monilia are to be identified, strict adherence to the particular method used must be enforced, and rechecks must be made on all atypical strains before the final report. Nevertheless, this should not discourage an interested worker. The method described here can be used with few special media in the ordinary bacteriological laboratory and by the technologist who has had no special training in mycology.

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LIVER FUNCTION TESTS*

By R. J. McGANN, M. D.

Knowledge of the functional status of the liver, gained by the use of tests, is growing in importance in medicine and surgery. Due to the multiplicity of its functions, no one test can possibly be expected to reveal everything about the liver. The reserve of the liver is so enormous and its capacity to function in the face of extensive damage or even the loss of large parts of its substance is so great that efficient performance is possible against unbelievable odds.

Tests of liver functions may be roughly classified under the headings of various functions of the liver which they are supposed to demonstrate. Most important are test of carbohydrate function, test of bile metabolism, test of excreory function, and tests of the detoxifying function, and is also a miscellaneous group of tests, many of which seem to be based on nothing more than chance observations. The following summary is not intended to be complete, but merely to illustrate representative tests which fall into each classification.

Tests of carbohydrate function consists chiefly of the galactose tolerance test. The basis of this test is based on the fact that the liver transforms the carbohydrates of the blood to glycogen and stores it as such. In the event of liver damage, this glycogenesis is impaired and the sugar appears in the urine.

Bile pigment metabolism: The endothelial and especially the reticuloendothelial cells of the body form hemobilirubin from hemoglobin. This pigment is probably connected with plasma protein and circulates in the blood but does not pass into the urine. It gives the characteristic diazo reaction (van den bergh) only after the serum protein has been precipitated with alcohol. Hemobilirubin is taken up by the liver cells and excreted into the bile capillaries as cholebilirubin, which supposedly is freed of the protein connection. In the intestine, cholebilirubin is reduced by bacterial action to urobilinogen. Most of the urobilinogen is excreted with the feces, to which it imparts color, and part of it is reabsorbed into the blood stream and reaches the liver. The liver reoxidizes most of it to bilirubin, which is again excreted in the bile. Traces of it remain in the blood and appear in the urine. Normally, traces of urobilinogen and no bilirubin are excreted in the urine.

Impairment of the bile flow can be demonstrated by the absence of urobilinogen from feces and urine. Elevation of the serum

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bilirubin level may be due either to retention of bilirubin in the blood because of increased supply to the liver as a result of increased blood destruction (hemobilirubin), or to regurgitation of bilirubin, which had already passed through the liver cells, from the bile capillaries into the blood stream (cholebilirubin). The hemobilirubin is connected with plasma protein and therefore fails to give the direct van den bergh reaction or to appear in the urine. The cholebilirubin gives the direct reaction and appears in the urine.

Regurgitation jaundice, manifested by the presence of direct bilirubin in blood and by bilirubinuria may be the result of both liver cell damage, i.e., break up of the liver cell cords, or of extrahepatic biliary obstruction which has caused dilatation and rupture of the bile capillaries. Of differential diagnostic significance is only the observation that a very high bilirubinemia (icterus index above 150 or more than 12 mg. per 100cc) is usually the result of liver cell dysfunction. Furthermore, a high percentage of indirect bilirubin when the total bilirubin level is above 3 mg. per 100cc. also points to a liver cell injury.

The icteric index is a simple, reasonably accurate test, the chief value of which is the demonstration of latent or sub-clinical jaundice and of fluctuation in the intensity of the icterus which cannot be detected by clinical observation. Valuable as it is, however, it is not a true test of liver function.

Excretory tests of liver function are based upon the principle of injecting specific amounts of some substance into the blood stream and determining the degree of retention at one or more intervals thereafter. A retention of bromsulfalein (more than 6 per cent after forty-five minutes if 5 mg. per kilogram are given) in jaundice may be due either to inability of the liver to excrete it or to an obstruction of the bile flow, though in incomplete obstruction the retention may be less marked.

The enzyme alkaline phosphatase, which in alkaline medium splits organic phosphorous compounds to phosphate, is formed by the osteoblasts as part of the process of calcium phosphate deposition in bone. The enzyme is excreted through the bile and interference with biliary excretion leads to an increase in the serum phosphatase level. Since cholesterol is also excreted in the bile, interference with the bile flow leads to increase in the blood cholesterol level.

Since the liver plays a main role in the production of serum protein, liver damage leads to a reduction of the serum protein. Since many other factors, especially malnutrition, produce a similar condition the differential diagnostic value of hypoproteinemia, as evidence of liver damage, is limited. Of more diagnostic value is the reduction of the albumin fraction. This plus

the occasional increase of the globulin fraction leads to a reduction of the normal albumin-globulin ration of 2:1, often even to a complete reversal of the ratio.

The prothrombin may be reduced in jaundice either due to insufficient absorption of vitamin K from the intestinal tract because of the absence of bile salts from the intestine (obstructive jaundice). In noncomplicated obstructive jaundice, medication with vitamin K restores the prothrombin time permanently to normal, whereas, in liver damage vitamin K increases the prothrombin level only slightly and for a short period.

The Quick hippuric acid test of the detoxifying function of the liver is based on the fact that after the intravenous administration of 1.7 gm. of sodium benzoate, less than .8 gm. of hippuric acid is excreted in the presence of parenchymal liver damage.

The cephalin-cholesterol flocculation test becomes positive in liver damage due to an increase in the gamma globulin and to a qualitative change of the albumin, both of which factors influence the stability of the cephalin antigen. The thymol turbidity test becomes positive somewhat later than the other tests and also persists for a longer period. The mechanism of this test is still questionable. It seems to depend upon the interrelation between lipids and protein.

Recently the histologic examination of liver biopsy specimens obtained either by needle puncture or by peritoneoscopy has been carried out on a wide scale. Obscure conditions associated with hepatomegaly have been clarified by this method. Moreover, the results of therapy can also be followed by it.

PARASITES ENCOUNTERED IN THE AMAZON VALLEY*

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When the Flying Clipper left Miami July 14, 1943, it took me to a land where life was very different from any that I had known previously. We stopped at Kingston, Jamaica, about noon to refuel, and spent the night at Maracaibo, Venezuela. At sunset the following day our plane circled over Manaus, Amazonas, 1000 miles up the Amazon River from Belem. This was my home for two years, during which time I was in charge of the laboratory of the Hospital Americano. The hospital was established for the purpose of caring for all the American and Brazilian personnel of the Rubber Development Corporation, an agency of the R.F.C. Our patients included also the men of the U. S. Army stationed in Manaus and the American missionary priests. The type of work was extremely varied as it included all branches of laboratory diagnosis. One of my most interesting tasks was the training of two Brazilian assistants who spoke only Portuguese. Learning the language of the natives was imperative, as few Brazilians understood English.

During my two years residence in Manaus, I spent one week in Belem, visiting the Evandro Chagas Hospital and the Evandro Chagas Institute, a research laboratory—both of which were under the direction of the Co-ordinataor of Inter-American Affairs. One function of the hospital was to train Brazilian nurses and laboratory technicians whose ultimate purpose was to accompany the native doctors into the interior.

I was fortunate to have the opportunity to observe under the Swiss entomologist at the Institute. Here were examined the specimens sent in by field workers throughout the Amazon Valley to determine the presence of vectors of disease. An important project was the study of the forty species of Phlebotomus, or sand-fly, the vector of Leishmania—donovani. Cutaneous leishmaniasis occurred among the jungle workers. The diagnosis of this form of the disease was made by cleansing the lesion well, injecting a local anaesthetic and obtaining some of the normal tissue surrounding the lesion. When stained with Wright's or Giemsa's stain the Leishman-Donovan bodies were found within the cells. Only the aflagellar stage is found in man. Flagellate forms are found in cultures and in sand-flies. Phlebotomus longipalpis, a member of the family psychodidae, is the species responsible for transmitting leishmaniasis in Brazil.

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One of the most serious diseases in Belem is filariasis caused by the nematode, Wuchereria bancrofti, which produces living embryos in the blood. It is conveyed through the bite of an infected culex mosquito. In Belem approximately 12 per cent of culex mosquitoes are infected. Fortunately for man, several bites are required to produce filariasis. Because of the nocturnal periodicity of the microfilaria, blood should be procured by venipuncture between the hours of 10 p.m. and 2 a.m. To 10 cc. of 2 percent formalin add 1 cc. of blood; mix well and let stand for 24 hours at room temperature. Decant supernatant fluid. Make smears from leukocytic cream and stain with Methylene Blue and Eosin Y or Giemsa's stain. Microfilaria may be demonstrated in thick smears also. In Brazil there is no racial susceptibility to filariasis.

A large map on the wall of the Institute office was evidence of the intensive work done on identification of species of Anopheles mosquitoes found in the Amazon Valley. Entomologists identify this species by the width of the alternate black and white stripes on the wings and by the color of the tarsus. Surveys showed that the incidence of malaria was high in regions where Anopheles darlingi was present. A. darlingi was the only anopheline found to be infected in the Amazon Valley. Thirty of the two hundred species are potential vectors of malaria. Some species are more susceptible to malaria than others, i.e. A. darlingi. Some feed on man more readily when the environment of choice is close to human dwellings. Others prefer remote streams, while the most favorable breeding grounds of some species are ruts, holes and empty cans filled with stagnant water. Many are potential vectors only if they are numerous. Anopheles gambiae was largely responsible for malaria in Natal and Ceara between 1930 and 1940. By concentration on control measures for species eradication this harmful anopheline has been eradicated from Brazil. Because of air transportation the health authorities are constantly alert for evidence of its return. In Belem 1-5 per cent of Anopheles mosquitoes are infected. One bite by an infected mosquito is sufficient to produce malaria.

There are fifteen species of Anopheles mosquitoes in Manaus, including A. darlingi which is responsible for a high incidence of malaria because of its preference for dwellings and the ease with which it becomes infected. The lack of screens on Brazilian homes was a contributing factor to the presence of malaria as well as the high incidence of amoebiasis. Most windows had neither glass panes nor screens. Doors also were open to mosquitoes and flies. Dr. Colin Beaton, our medical director, urged all Americans to have their houses screened. Since it was difficult to obtain screening, many windows were covered with mosquito netting. In all unscreened houses the bed net had its im-

portant place. This consisted of fine mosquito netting gathered in a circle above the bed and supported on a frame. By pulling a cord at bed time the whole bed could be encased in fine net. Since mosquitoes were most active at dusk and daylight, we were urged not to sit out of doors in unscreened patios.

We found the lowest incidence of malaria in December at the end of the dry season. During May and June following the rainy season the highest incidence occurred. Children had more serious cases of malaria than adults because it was usually the first attack. After an individual has had malaria, a subsequent attack is likely to be milder. If malaria develops during the period of prophylaxis it is very difficult to eradicate since the plasmodia develop resistance to the prophylactic drug. When the few plasmodia have developed to the point where fever results, they will not be affected by drugs. They are resistant to the drug used in prophylaxis as well as to other drugs which have similar radicals. All of our rubber technicians and the army personnel who went into the interior took atabrine prophylactically.

Pl. falciparum and Pl. vivax were found most commonly. Between July 15, 1943, and May 1, 1945, there were in residence in Manaus 524 Americans—all employees, or their families—connected with the Rubber Development Corporation. Of these, 42 or 8 per cent developed malaria. The total number of malarial patients was 247, including 205 Brazilians—83 per cent and the 42 Americans constituting 17 per cent. Of the total, 65.9 per cent were infected with Pl. falciparum, and 34.1 per cent had Pl. vivax. The percentage among the Brazilians was comparable, since 65.3 per cent were infected with Pl. falciparum and 34.7 per cent had Pl. vivax. Gametocytes were found in three patients.

Two Americans and five Brazilians suffered recurrences. Most of the recurrences among returned Army men have been due to Pl. vivax. Of the total number of malarial patients 39.2 per cent were hospitalized, and 60.8 per cent were out patients.

10.7 per cent of the total positive findings occurred in thick smears only. The technic of the thick smear is simple, and after a little practice one becomes adept at recognizing the plasmodia in the absence of the red blood cells. Because of the larger volume of blood employed, a diagnosis can be made when only a few parasites are present in the circulating blood. We used the following technic: the finger is first cleansed with alcohol, the skin is then pricked. The alcohol must be thoroughly removed or it will fix the cells. Five small drops of blood are placed near the end of the slide in such a manner that they cover an area equal to that of a dime. With an applicator the drops are joined together carefully so as not to defibrinate the blood. Should this occur, or if the drop is too thick, it will tend to crack and fall off. Each day

a fresh preparation of Giemsa solution is made by diluting 1 cc stock 0.3 per cent Giemsa stain with 10 cc buffer solution. The slide is covered with the diluted stain and allowed to stand for 45 minutes, after which it is washed thoroughly. The dilute Giemsa stain hemolyzes the R.B.C. and the stains the leukocytes and plasmodia.

I should like to recommend the "Manual for the Microscopical Diagnosis of Malaria in Man" compiled by Aimee Wilcox for its excellent illustrations of plasmodia. A copy may be obtained for thirty-five cents ($0.35) by writing to the U. S. Public Health Service, Washington, D. C.

While malaria was a serious health problem in Manaus, it was of secondary importance to amoebiasis. Our medical director issued written suggestions to all personnel emphasizing the urgent need of having fly-proofed dining rooms and kitchens. We were instructed not to drink unboiled water, and to rinse all dishes with boiling water. Laboratory tests proved that the city water was not potable. We were told to eat only cooked or peeled fruits and vegetables. There were frequent warnings against swimming in the local pools since analyses of the water indicated gross contamination with E. coli. Since the local milk supply was unsafe, we used only the dehydrated form. Everyone was asked to have a stool examination at least once a month and immediately in case of diarrhea. All Americans were urged to send prospective maids and cooks to the hospital for stool examinations before employing them and at subsequent intervals after hiring them.

Since it is important to examine feces while fresh, wherever possible the specimens were collected at the hospital and examined immediately. Patients were instructed not to take an oil laxative previously as the fat globules interfere with the microscopic examination. The routine procedure consisted of direct warm-stage examination of a small fleck of fecal material emulsified in isotonic salt solution on one end of the slide and a similar preparation stained with iodine on the opposite end. Cover slips were applied. The iodine solution consisted of 1.5 per cent iodine and 1 per cent potassium iodide dissolved in distilled water and allowed to ripen in a brown bottle for four days before filtering. This proved to be very helpful in identification of amoebic cysts. A careful gross examination of the specimen before selection of the portion to be emulsified is most important. If mucus or blood is present this should be chosen. All specimens containing leukocytes were cultured. The careful preliminary examination is also an aid in detecting the presence of adult worms of Enterobius-vermicularis. For diagnosis of oxyuriasis the method of choice is the NIH swab used early in the morning before defecation and bathing. The percentage of positives is

much higher than that obtained by concentration of stool specimens.

The Zinc Sulphate Centrifugal Flotation method was employed on those specimens which were negative on direct examination. A fecal suspension was prepared by emulsifying one part of the stool in about ten parts of isotonic salt and filtering through two layers of gauze to remove food particles. The filtered portion was collected in a centrifuge tube, centrifugalized for 1 minute; the supernatant fluid decanted and the tube filled with isotonic salt solution. Washing was continued until the supernatant fluid was clear (about three times). After decantation the tube was filled with zinc sulphate (U.S.P. granular) solution of specific gravity 1.175. A heavy liquid hydrometer was used for determining the specific gravity. The disparity between the sp. gr. of 1.175 and 1.180 in the published method is due to the results of comparable tests at Charity Hospital in New Orleans where the less dense solution was found to give a higher percentage of positives. After mixing the sediment and zinc sulphate solution thoroughly, the tube was centrifugalized for 1 minute, and zinc sulphate was added drop by drop until the solution formed a convex surface above the rim of the tube. After two minutes, a cover slip was touched to the surface of the liquid and placed on a slide. A second cover slip was treated similarly and placed on a drop of iodine solution. One essential precaution is to avoid contact with cresol compounds or formalin as these substances interfere with the effectiveness of the Zinc Sulphate Flotation method.

In our expereince the zinc sulphate method proved of great value in detecting ova of helminths in treated cases where none was found on direct examination. It is an aid also in finding anoebic cysts where the number is limited.

An iron-hematoxylin staining method was an additional aid in differentiating the amoeba, especially the small races. "The Rapid Technique for Iron-Hematoxylin Staining," by Carl M. Johnson of the Gorgas Memorial Laboratory, Panama, published in "The American Journal of Tropical Medicine," Vol. 15, No. 5, September, 1935. proved to be simple, reliable and adaptable to our needs. One advantage of this method is that it does not require microscopic control of decolorization.

A total of 2237 stool examinations was made from 1246 patients. Of these, 723 were specimens from 300 American patients, and 1514 were specimens from 946 Brazilians. In the group of Americans there were 22 children. Among the Americans examined the following parasites were identified: ova of Ascaris lumbricoides in stools of 11 patients, trophozoites of Chilomastix mesnili in 14, Trichomonas hominis in 21, trophozoites and cysts of E. histolytica in 122 (40 per cent), trophozoite of Iodamoeba butschlii in 1, cysts of Giardia lamblia in 2, ova of N. americanus

in 2, ova of Trichocephalus trichiurus in 9, Tyroglyphus longior in 1. The latter is a sarcoptoid mite which feeds on cheeses and cereals. Two patients were infected with Larva migrans.

Two cases of infection with N. americanus are noteworthy because of the similarity of the blood picture. One patient a woman, had two negative stool examinations followed by several in which ova of N. americanus were recovered. The blood picture was as follows: W B.C. 19,600, R.B.C. 4,700,000, Hbg. 14 grams per cent, polymorphonuclear neutrophiles 30 per cent, segmented 29 per cent, non-segmented 1 per cent, eosinophiles 46 per cent, monocytes 2 per cent and lymphocytes 22 per cent. Frequent blood counts revealed a constant leukocytosis and a marked eosinophilia.

Mr. N. came to the laboratory for a routine examination. The findings were as follows: direct examination of the stool was negative; the concentrated specimen contained few ova of N. americanus. The blood picture showed W.B.C. 35,900, R.B.C. 4,800,000, Hbg. 15 grams per cent, polymorphonuclear neutrophiles 15 per cent, segmented 13 per cent, non-segmented 2 per cent, eosinophiles 62 per cent and lymphocytes 23 per cent. Over a period of several weeks there were many stool examinations showing ova of N. americanus. The blood counts were characterized by a leukocytosis and an eosiniphilia reaching a maximum of 70 per cent. Neither patient had the typical hypochromic anemia.

Two cases of Larva migrans, the cutaneous lesion caused by the filariform larvae of canine or feline strains of Ancylostoma braziliense, were evidence of the ease with which man becomes infected in the tropics. One patient, an American boy aged 6, was devoted to a dog which was a gift from a Brazilian. The other patient, also an American, had a small garden in which he enjoyed working. Both the patients developed lesions on the forearm, a site readily infected when the skin is exposed to the moist soil where dogs infected with A. braziliense previously have defecated. The mature filariform larvae in the soil invade the skin producing an erythematous lesion which soon becomes elevated. In a few days a tunnel is produced in the layers of the skin, and the larvae move a few centimeters each day. The abandoned portions of the tunnel become dry and crusty. As the larvae move forward they produce an intense pruritus which causes scratching with subsequent pyogenic infection. The canine and feline strains of A. braziliense do not invade the tissues below the skin. In neither case were ova found in the feces. Both patients responded to treatment by freezing the infected area with ethyl chloride.

It is evident from the high incidence of amoebiasis that E. histolytica was the parasite of gravest concern. Among the Americans 111 adults and 11 children were infected. Of the 122

individuals, four harbored only cysts while the remaining 118 had trophozoites or a combination of the vegetative form and cysts. Eighty-three persons—27 per cent—had only E. histolytica; 14 persons had E. nana in addition. In the feces of the remaining 13 per cent there were flagellates and ova of various helminths as well as the E. histolytica. A curious observation was the frequent presence of large numbers of trophozoites of Chilomastix mesnili in feces containing E. histolytica.

One hundred thirty-three Americans—44 per cent—showed no evidence of parasitic infection after repeated examinations, forty patients—13 per cent—had multiple infections—twenty-seven had one parasite in addition to E. histolytica; nine had two additional types, and four individuals harbored three other parasites.

The total number of Brazilians examined was 946. Ova of Ascaris lumbricoides were present in 266 patients, trophozoites of Balantidium coli in 4, trophozoites of Chilomastix mesnili in 35, trophozoites and cysts of E. histolytica in 371, cysts of Giardia lamblia in 2, ova of N. americanus in 99, larvae of Strongiloides stercoralis in 56, Proglottids of Taenia saginata in 1, ova of Trichocephalus trichiurus in 225, Trichomonas hominis in 72, Enterobius vermicularis in 1, and Tyroglyphus longior in 7.

Of the 371 Brazilians—39 per cent—infected with E. histolytica, 91 (9 per cent) had only this parasite while 280 (29 per cent) patients had more than one type of parasite; several individuals were infected with five types concurrently. Negative stools were recorded in 120 (12 per cent).

Among both the American and Brazilian personnel the highest incidence of parasitic infection was that of E. histolytica. Forty per cent of the Americans harbored trophozoites and cysts of E. histolytica. The incidence of this same parasite among the Brazilians was 39 per cent. There is a greater disparity between the two groups in the percentage of negative individuals—44 per cent of the Americans and only 12 per cent of the Brazilians.

A peculiar parasite known in Brazil as bichou de pe (insect of the foot) was commonly found among the two groups. It is a small white worm, about 5-8 mm. in length which burrows its way through the skin of the foot, becomes tightly coiled, and lays hundreds of eggs. The nest becomes an encapsulated mass about 7 mm. in diameter, and produces symptoms of pruritus, erythema and edema. Man becomes infected by walking barefoot where infected pigs or dogs have contaminated the floor or ground.

The two years experience in the tropics was not only a source of valuable information, but also a memorable and interesting one.

TEACHING NOTES

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I. ON THE CLINICAL DIFFERENTIATION OF COMMON SUGARS IN URINE

Most text books on clinical laboratory methods do not emphasize the slightly growing importance of sucrose as it is used by the neurotic and malingering patient who attempts to convey the impression that he is diabetic. Also the sugars of infants and nursing mothers are not always differentiated from glucose.

In teaching, therefore, at Hunter College the following simple exercise is offered:

A series of unknowns, freshly made up with roughly 2 to 3 + sugars, is said to include the urines of (a) a new, uncontrolled diabetic patient, (b) a perfectly controlled diabetic (this may serve as experiment control, although the importance of controls should be emphasized), (c) a nursing mother or child, and (d) a malingering patient.

A sample of each urine is shaken up with a morsel of fresh yeast cake in a fermentation tube, and the tubes are placed under a covered goose-neck lamp. Each urine is tested with Benedict's qualitative reagent and set to cool.

The student then goes about other analyses, allowing approximately an hour for fermentation. The Benedict and the fermentation tests are then compared and a table plotted to show results. *Osgood and †Bray are used for principal references.

	Reduction	Fermentation	Sugar Type
1	—	—	no sugar (controlled diabetic)
2	+	—	lactose (nursing mother or child)
3	+	+	glucose (uncontrolled diabetic)
4	—	+	sucrose (malingering patient)

This exercise emphasizes the ease with which clinically common sugars may be distinguished.

* A Textbook of Laboratory Diagnosis, E. E. Osgood; 3rd Ed., p. 348; Blakiston Co., 1944.

† Synopsis of Clinical Laboratory Methods, W. E. Bray; 3rd Ed., p. 50; Mosby Co., 1946.

II. DIRECT CROSS-MATCHING OF BLOOD

Several of the texts* listed below, which are used at Hunter College in teaching the course in Clinical Pathology, and also other important references** give excellent graphic methods of distinguishing blood typing results; but no one of them presents the problem of cross-matching with parallel precision and conciseness. The understanding of cross-matching ranks first in the clinical application of this subject.

Typing and the theory of agglutinogens-agglutinins, the genetics, anthropology and animal variations in the blood groups are taught first as background foundation. Each student types her own blood and observes all of the class material. Then the emphasis of the whole subject is stressed in cross-matching.

The class exercise, following presentation of the Wright capillary method of obtaining blood for cells and serum, begins with suggestions from the Army Manual. Each students prepares, with wax pencil, four microscope slides; these with $\frac{\textit{Donor Cells}}{\textit{Recipient Serum}}$ in one corner and $\frac{\textit{Donor Serum}}{\textit{Recipient Cells}}$ in the other corner. Certainly the matter of which order of $\frac{DS}{RC}$ and $\frac{RS}{DC}$ is *not* stressed.

On each slide the student then imitates, with wax pencil, the non-agglutination and the agglutination phenomena she has just observed in examining the typing slides of the whole class. (The slide method is used in practice as the more graphic, although the test tube method is also taught.)

Four cross matching conditions may occur; the student must bring her four slides to the desk and describe in accurate langauge the condition of each; she must then record each concisely in her notebook. The notebook page resulting follows.

Experience has shown that without this graphic method the student does not grasp the problem readily, nor does she retain it long. But with these four pictures of cross-typing phenomena in her mind she is in firm possession of the facts and their implications.

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* Kolmer and Boerner, Approved Laboratory Technique; Appleton Century, 4th ed.

Osgood, Laboratory Diagnosis; Blakiston, 3rd ed.

Sitt, Clough and Clough, Practical Bacteriology, Hematology Parasitology; Blakiston, 9th ed.

Todd and Sanford, Clinical Diagnosis by Laboratory Methods; Saunders, 10th ed.

** Gradwhol, Clinical Laboratory Methods and Diagnosis; Mosley, 3rd ed.

Wadsworth, Standard Methods; Williams and Wilkins, 2nd ed.

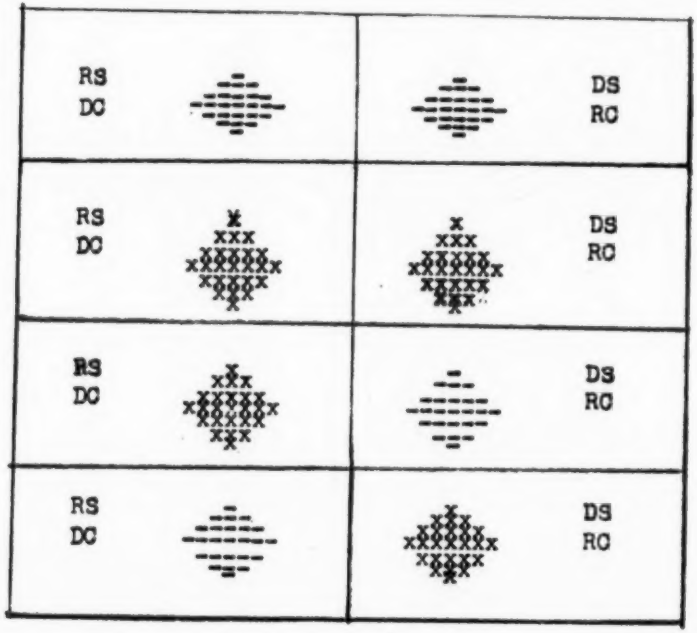
Methods for Laboratory Technicians, Technical Manual 8-227; War Department, 1941.

No agglutination occurs. The bloods are compatible. Transfusion may be expected to give optimum results.

Agglutination of both sets of cells occurs. The bloods are incompatible. Transfusion would be fatal.

Agglutination of the donor's cells occurs. The bloods are incompatible. No known procedure can prevent this clumping. Transfusion would be fatal.

Agglutination of the recipient's cells occurs. The bloods are incompatible. If transfusion were given slowly the donor's serum would be so diluted in the recipient's blood stream that few of the recipient's corpuscles would be affected. Transfusion may proceed, in emergency, and slowly, with but slight unfavorable reaction.



EDITORIAL

EDITORIAL POLICY OF THE AMERICAN JOURNAL OF MEDICAL TECHNOLOGY

By our speech ye shall know us. By a publication the organization which sponsors it shall be known. The AMERICAN JOURNAL OF MEDICAL TECHNOLOGY is the official organ of the American Society of Medical Technologists. To have the responsibility of presenting to the readers of our publication only that which will be helpful and instructive to them as medical technologists is no small task. To present a publication which will reflect only the most in scientific value to medical technologists is to require the cooperation of all those members of our profession who are actively engaged in it. To present to a membership which is growing larger in size, greater in unity, and more conscious of itself as a profession, and more able to express itself as an entity, a magazine which will be only of positive worth to its readers, is again to call upon the assistance of each individual member as well as upon those groups of members who have banded together and successfully gained recognition as a unit. The general responsibility belongs to each and every member of the American Society of Medical Technologists. The immediate and final responsibility belongs to that small group of individuals selected by your Board of Directors, the Editorial Staff.

It is our responsibility to present to you a publication of which you need not be ashamed as the official organ of your profession. You receive the papers which were presented not only at the national convention, but many given at smaller meetings, at state or local societies, as well as an occasional article which is not long enough to read before a convention, but which is of decided value technically. These latter are welcomed in that they are of practical worth.

As the official organ of the American Society of Medical Technologists, the Journal attempts to give the membership an account not only of what has transpired at the national convention, but of what other smaller organizations are accomplishing in their state and local units. The professional side of medical technology, as well as the technical, has its place. To balance these is also our responsibility, and not an easy one. To do this, to maintain a certain dignity befitting our profession, to maintain the high ideals and integrity of our profession, and above all, to do it in such a way that respect for medical technology as a profession be built constantly and firmly, calls for no little effort and alertness on our parts. No doubt there will be an occasional point of disagreement, not only by individual members, but by

larger units, with material presented. The editorial staff does not always agree, nor are opinions expressed by the authors always in accord with those of the editorial staff. But, as the American Society of Medical Technologists has its affiliated state organizations, and is made up of individuals from much more than one small corner of this earth, we can attempt only to present that which will enhance our profession, and in such manner that there will be no moving backward, and little lost motion.

R.M.

WOULD IT BE WISE?

For the registered Medical Technologist (A.S.C.P.) to subscribe to such a directory listing as is being circularized from a box number in Tacoma, Washington, with no qualifications required other than the payment of a $10.00 fee? Your national organization has no knowledge of this except through the alertness of one of its members who has called it to the attention of several Board members. We wish to remind you that your name, and address, as a qualified member of your profession, is listed in the Roster of the American Society of Medical Technologists.

The Harris County (Texas) Society of Medical Technologists went on record as strongly approving the action of the A.S.M.T. House of Delegates in the resolution opposing the Registry's proposed certification of junior grades of laboratory workers and of certifying specialists with less than a degree at a Master's level.

ABSTRACTS

I. Urinalysis:

MEASURING THE SPECIFIC GRAVITY OF SMALL AMOUNTS OF URINE. A rapid and simple method. By Ihsan Dogramaci, M.D. (Department of Pediatrics, Washington University School of Medicine, and the St. Louis Children's Hospital, St. Louis, Mo.) Jour. Ped. **30:** 672, 1947 (June).

The fact that a specific gravity determination is an essential part of the laboratory investigation of disorders of the kidney or water metabolism, and also that it is difficult and inconvenient to collect urine specimens of sufficient volume from tiny babies to permit a specific gravity determination by the clinical urinometer, led the author to work out a method by which specific gravity could be determined within the range of required clinical accuracy on small quantities of urine and other fluids.

The Method

"Drops of urine are allowed to fall into a graded series of oily solutions made up by mixing kerosene and bromobenzene in varying proportions, ranging in specific gravity from 1.000 to 1.060. Note is made in each instance whether the urine drop rises or sinks in the given test solution, in a manner similar to that used in determining blood specific gravities with copper sulfate solutions.

"A series of sixteen test mixtures are graded from 1.000 to 1.030 at intervals of 0.002, and eight test mixtures ranging from 1.032 to 1.060 at intervals of 0.004.

"For urine, a medicine dropper with a fine capillary tip is used, or a 20 c.mm. hemoglobin pipette, if the quantity of urine is too small. The tip of the pipette is brought about 3 cm. below the surface of the test solution, or to a point slightly above the center of the bottle, and a drop is gently forced out.

"If the drop is of the same specific gravity as the test mixture, it will tend to remain stationary in the solution; if heavier, it will sink to the bottom of the bottle; and if lighter, it will rise to the surface. According to the result in the first test bottle, others are selected until one is found in which the drop of urine remains stationary. Thus, the specific gravity can be determined within 0.001 if the unknown is a 1.032 or less, and with 0.002 if denser than 1.032."

The author recommends that the initial trial be made with the 1.020 bottle and then proceed to the 1.030 or 1.010 as indicated.

Preparation of Standard Solutions

"Two stock solutions are first prepared, one of 952 ml with a specific gravity of 1.000 and the other of 688 ml with a specific gravity of 1.060."

The author recommends that the specific gravity of the stock solutions be checked by any of these three methods and adjusted to the exact value.

1. Pycnometry.
2. Copper sulfate of 1.060* and distilled water as 1.000 for test drops of known specific gravity.
   *1.060 Copper sulfate: 9.850 Gm $CuSO_4$, 5 H_2O).
3. By use of a certified clinical urinometer.

Extra amounts of the solutions of specific gravities 1.020, 1.010, and 1.030 are recommended as these are the ones most frequently used.

Burettes are convenient for measuring the required amounts of the stock solutions.

60 ml bottles with tight screw caps are recommended for the test solutions.

"A kerosene-bromobenzene ratio of 70:30 yields a specific gravity of about 1.000, and one of 62:38 will be approximately 1.060.

MILLILITERS OF STOCK SOLUTIONS OF GRAVITIES 1.000 AND 1.060 TO BE MIXED TO PREPARE 60 ML OF STANDARD TEST SOLUTIONS OF GRAVITY G.

No.	Gravity	Stock sp. gr. 1.000	Stock sp. gr. 1.060
1	1.000	60	0
2	1.002	58	2
3	1.004	56	4
4	1.006	54	6
5	1.008	52	8
6	1.010	50	10
		prepare in duplicate	
7	1.012	48	12
8	1.014	46	14
9	1.016	44	16
10	1.018	42	18
11	1.020	40	20
		prepare in duplicate	
12	1.022	38	22
13	1.024	36	24
14	1.026	34	26
15	1.028	32	28
16	1.030	30	30
		prepare in duplicate	
17	1.032	28	32

No.	Gravity	Stock sp. gr. 1.000	Stock sp. gr. 1.060
18	1.036	24	36
19	1.040	20	40
20	1.044	16	44
21	1.048	12	48
22	1.052	8	52
23	1.056	4	56
24	1.060	0	60

It is felt that temperature corrections are not necessary for clinical work.

Each test solutions in the hands of the author has given good results after the addition of 80 drops of urine to the test solution.

II. Hematology

EVALUATION OF BONE MARROW CONCENTRATION TECHNIQUES. A Modified Method for the Simultaneous Preparation and Staining of Blood and Bone Marrow Films. By Louis R. Limarzi, M.D., Assistant Professor of Medicine, University of Illinois, College of Medicine, Chicago, Ill., Jour Lab and Clin Med *32:* 732, 1947 (June).

Dr. Limarzi's article is one of the outstanding contributions of the year to actual hematological technology. His approach on how to study bone marrow is worth the time required for reading the original article. The abstractor recommends this article to all students of medical technology. The illustrations are excellent.

Due to the fact that the Journal of Laboratory and Clinical Medicine may not be available to all of our readers, we are quoting the actual technic verbatim.

———"exactly 1 cc of marrow fluid is aspirated and immediately placed in a paraffin-lined tube containing a minute amount of heparin.* The tube is gently inverted several times to insure the anticoagulant effect of the heparin. Usually, if a successful sample of marrow has been obtained a more or less dense suspension of small tissue particles will be visible. The 1 cc of heparinized material consisting of peripheral blood (sinusoidal), hemopoietic marrow, and fat is pipetted into a Wintrobe hematocrit tube and centrifuged for approximately five minutes at about 2,000 r.p.m. Centrifugation separates the following layers reading from top down in the tube:

(1) fat, yellow and red
(2) plasma
(3) myeloid-erythroid cells—this layer also contains megakaryocytes
(4) erythrocytes from bone marrow sinuses

* Powdered heparin, Lot No. 153, Hynson Wescott, and Dunning Baltimore, is inexpensive and 1.0 gram will suffice for 350-400 sternal punctures.

"The heights of the several Layers are recorded. Normal average quantitative values for adults as represented in the hematocrit tube are as follows:

Fat (yellow and red)....	3.2%
Plasma	45 %
Myleoid-erythro (M-E)..	6.8%
Erythrocytes	45 %

———"of these values the myeloid-erythroid is of hematologic significance."

"The fat and most of the plasma are removed separately and discarded. The myeloid-erythroid layer, together with a small amount of plasma, is pipetted off separately, transferred to a paraffin-lined watch glass, mixed, and from this material, films and cell counts are made."

The author and his associates have used this method in more than 3,385 practically simultaneous studies of the bone marrow and peripheral blood.

Preparation of Marrow-Blood Films by Double Slide Technique:

In order to utilize a microslide for films of both blood and bone marrow, the following technic is used: Place a small drop of concentrated marrow fluid on the near lower edge of a scrupulously clean standard 3 x 1 inches microslide approximately one-quarter of an inch from one end of the slide. With a second slide, one end of which is used as a spreader and held at an angle of 30 to 45 degrees, touch the second slide to the first slide so that the drop of blood is within the angle thus formed. Draw the second slide toward the drop of blood until the slide just touches the drop and the blood spreads along the acute angle by capillarity. A moment is allowed for this to occur after which both slides are opposed and the blood is "sandwiched" and spread between them. The slides are then immediately and quickly drawn apart. The first slide which contains the useable film of the bone marrow is finally dried by air in motion. On the opposite end of the same slide, place a drop of blood from the finger or ear and repeat the procedure as described for making the bone marrow film. This bone marrow-blood microslide preparation is now ready for staining. Before staining, a thick line by means of a marking pencil is drawn along the inner edge of both the bone marrow and blood films. The marking pencil line serves to prevent the stain from overflowing and prematurely staining the blood film on the opposite end of the slide. Note that the bone marrow and blood films are spread along the width of the microslide rather than the conventional length of the slide. A good bone marrow and peripheral blood preparation should be smooth, homogenous, and have even edges. The films of the bone marrow and periph-

eral blood should occupy approximately the opposite one-third of the end of the slide. The area between the inner edges of the bone marrow and blood films, after the preparation has been stained and the marking pencil marks have been wiped away, is sufficient space for ordinary labeling."

Staining of Bone Marrow and Peripheral Blood Preparation:

"For general routine work, Wright's Stain is most satisfactory. The preparation is placed on a staining rack and the bone marrow film is stained first. The "square" with the bone marrow film is covered with Wright's stain and allowed to act for three minutes, this procedure serving to fix the smear. The stain is then diluted with distilled water, as much as the lower end of the slide containing the bone marrow film will hold, mixing very thoroughly; the marking pencil line along the inner edge of the film prevents the stain from overflowing to the opposite end of the slide and staining the blood film prematurely. Allow this to stand approximately fifteen minutes; without washing immediately begin staining that portion of the slide with the peripheral blood film in the usual way, that is Wright's stain one and one-half minutes followed by distilled water for three minutes, mixing thoroughly. At this point, the entire slide may become diluted following the overflow from both ends of the slide. The entire staining period should not exceed twenty minutes. Finally, rinse the entire slide with distilled water until the water runs, returning clear while tilting the slide. Wipe off the marking pencil marks and rinse with distilled water for a second time, place in a vertical position in a slide rack and allow to air-dry. If this procedure is followed there will be obtained a well-tinted bone marrow and peripheral blood preparations with no film or precipitated stain visible.

"Preparations made according to concentration technique give bone marrow patterns comparable in certain respects to those seen in bone marrow sections; thus they are called tissue-like preparations. With the oil immersion objective, a differential count may be performed. This is simplified by the use of an ocular which contains a Whipple grid to divide the field into segments. By moving the stage one can readily examine the peripheral blood; thus, the peripheral blood and bone marrow films are available for examination on the same microslide.

The author comments that his method of concentrating and preparing bone marrow has a number of advantages:

"(1) Myeloid-erythroid (M-E) hypoplasia and hyperplasia is relatively accurately measured; thus, quantitative changes (myeloid-erythroid volume in the hematocrit tube) as well as qualitative studies (differential counts of the bone marrow film) may be correlated. (2) The separation of the erythrocytes in the

hematocrit tube, most of which are derived from the sinuses of the bone marrow, eliminates the admixture of peripheral blood that is responsible for the dilution of the bone marrow elements. (3) Fat which interferes with the proper staining of the bone marrow cells is removed by the centrifugation of the marrow fluid. It also gives a relatively accurate estimation of the amount of fat in the bone marrow specimen which is of value in the study of certain diseases. (4) The method lends itself to the preparation of a large collection of uniformly prepared and stained films for teaching classes in clinical pathology and hematology.—It is an ideal method of filing both blood and bone marrow films for future reference."

Dr. Limarzi's method for preparing Wright's stain is as follows: "Wright's stain is prepared by dropping 1 Gm of certified Wright powder on the surface of 600 cc of chemically pure (acetone-free) absolute methyl alcohol in a ball mill containing one charge of pebbles. The ball mill is allowed to rotate in an electrically propelled machine overnight. The stain is stored in a tightly-corked 800 cc dark brown bottle and allowed to stand about seven days. The stain is filtered into a 60 cc dispensing bottle and kept tightly corked when not in use.

"If a ball mill is not available, grind 0.1 Gm of Wright powder with a few cubic centimeters of the alcohol in a mortar. Slowly add the alcohol a few centimeters at a time, until 60 cc of alcohol is added, then grind slowly. This process should take from twenty to thirty minutes. All the stain must go into solution. If possible, allow to stand one to two days. Filter before use."

Double or triple distilled water is recommended as the diluent for the stain, and in the hands of the author gave more constant results than buffer solution of pH 6.4.

21 references are cited on the subject of bone marrow.

III. Bacteriology

SIMPLE MEDIUM FOR MAINTENANCE OF MENINGOCOCCI. By Max Levine and A. R. Thomas, Jr., (From the Clinical Laboratory Service, Brooke General Hospital, Fort Sam Houston, Texas.) Jour. Bact. *53:* 33, 1947 (January).

The fact that meningococci do not remain viable on blood agar warranted an investigation which would provide a more suitable medium for the determination of fermentation characteristics, preservation, and shipment of **Neisseria** (particularly meningococci). Cultures of meningococci grown on the medium were found to be satisfactory as antigens for agglutination reaction, and gonococci grew well after primary isolation.

A. "**Meningitis carbohydrate media (for determination of fermentation reaction of Neisseria).**

Beef extract broth	1,000 ml
Agar	2 gm.
KCl (1%)	20 ml
$CaCl_2$ (1%)	10 ml
Starch (corn)	10 gm.

(Note: The usual sugars are glucose, lactose, maltose, and sucrose).

To prepare 100 ml proceed as follows:

1. To 100 ml beef extract broth add
   a. KCl (1%) ..... 2 ml
   b. $CaCl_2$ (1%) ..... 1 ml
2. Prepare starch paste by adding to 1 g of corn starch, in a mortar, 5 to 10 ml of cold water, grinding mixture into a fine paste.
3. Add this cold starch paste slowly to about 50 ml of the medium, boiling continually and stirring. Continue boiling for 5 to 10 minutes. Make up loss with boiling water.
4. Add this 50 ml starch-BXB mixture to the remaining 50 ml of the medium, continually boiling and stirring.
5. Adjust the reaction pH 7.4 to 7.6.
6. Add 0.2 g of agar and boil to dissolve.
7. Make up any loss due to evaporation.
8. Add 10 ml of 0.02 percent phenol red.
9. To each 100 ml of the medium add 0.5 (or 1.0) g of a desired carbohydrate.
10. Distribute 4 to 5 ml quantities into Loeffler tubes.
11. Sterilize in the autoclave at 10 to 15 pounds for 10 minutes.
12. Remove from the autoclave and cool quickly by placing tubes immediately in cool water.

B. "**Meningitis Stock Medium (particularly for preserving meningococci and other varieties of Neisseria).**

This is prepared in the same manner as described above for "meningitis carbohydrate media" except that glucose only is employed in a concentration of 0.03 percent (0.3 gm. per 1,000 ml). This is distributed in 6 to 8 ml quantities in 16 mm tubes. Sterilization is carried out as described above.

C. "**Meningitis agar medium (for shipping or preservation of cultures). Same as B but containing 1.5 to 2 per cent agar and prepared as slants.**"

AN OPEN LETTER TO THE MEMBERSHIP OF THE A.S.M.T.

Dear Fellow Members of the A.S.M.T.

I wish it were possible for me to sit down and talk to each and every one of you concerning our organization as it is now, and of plans for the future. Since that, of course, is not possible, I am taking this medium for writing each of YOU a letter.

To those of you who were not at the national convention in Denver, I am sure that by this time you have heard what an excellent meeting we had. The program, the entertainment, and the attendance were all record breaking. The heartfelt thanks of our entire organization, I know, go to the Colorado group for their work during the year, which made our 1947 convention such a great success. We also had the largest and most representative (geographically, at least) House of Delegates that we have ever had. Thirty-three states, the District of Columbia, Canada, and the Territory of Hawaii were represented.

The House of Delegates accepted, as you all know, with very few changes, the Constitution and By-laws as presented to the membership by the committee in the March, 1947, Journal. The discussion in the House of Delegates showed how very carefully the membership in the respective states had studied these changes before coming to the meeting. We believe that we have a good Constitution and By-laws, a document under which our organization should grow and progress. In some respects it is quite different from the old one. Modifications may have to be made from time to time as problems arise, but this can be done with dispatch at an annual meeting as the By-laws were purposely designed for a progressive profession. It represents the will of the majority so before we make further changes or are too critical of something we do not understand clearly, let us give this a fair trial. What might work very well in one part of the country would not be the best for all in another section. This was brought very forcibly to my attention during the past year when having moved from the Middle West to the East, I found conditions quite different—working conditions as well as organizational problems. What might be very fine for California might not work at all well in New York or Maryland, so we shall have to proceed slowly and learn to respect the problems of others.

One of the most important and far reaching changes was the setting up of eight standing committees of six members each to regulate and to work with the problems of the society. In an organization as large and as fast-growing as ours it will be necessary that much of our work be done through committees. The framers of our new constitution foresaw that need and planned wisely. Elsewhere in this issue you will find the names and ad-

dresses of the Chairmen of these committees who have accepted the responsibilities of working with us. I had hoped to have the complete lists ready, but with August being a vacation month, it was not always possible to have prompt replies from members contacted. Then, too, to appoint forty-eight persons to serve on the committees to which they are best fitted is quite a responsibility. This has been my problem, and I need the help of each one of you. On these committees we should have members who are interested in that particular phase of work with which each deals. We should have members also who are willing to work (for it will be work). Then we should have members who are geographically well distributed so as to represent better the country as a whole. As you can readily see, it is no easy matter for one person to make these forty-eight selections without the whole-hearted cooperation of the membership of our organization. In the future only two members per committee will have to be appointed annually, so there will be old and new members working together, but in this year, the first for most of these committees, there is quite a responsibility for one person to make forty-eight selections from the membership at large. As all of you know, some of the states are unorganized, so we do not know the capabilities of our members in those states as well as those who have worked diligently for A.S.M.T. in the well organized and older groups. Some of you may feel that your state has been neglected or that undue preference has been given to members in organized groups. This, I am sure, will clarify for you the reason. I would appreciate having many of you (especially from the unorganized states) write to tell me of your interest in any particular committee and offer to serve on it. By your interest I will know that you will work. (For the duties of the members of each committee, read your copy of the revised By-laws).

Several members of the Board of Directors have been selected as Chairmen or members of these committees. I would like to explain the reason for this. Since most of the committees are new, I felt that members elected by you, members who have already proved their willingness to serve, and who know the background and needs of the Society should be placed on these committees to work with the newer members until the committees function smoothly.

So, to each and every one of you, I would like to make these requests. Work with, and through, these committees. Send your suggestions, ideas, and criticisms to the Chairmen of the committees so that we may have a clearing house for our problems. If you are not sure just what committee should handle any specific matter, send your question to the Executive Secretary who will forward it to the proper person. Cooperate with our Executive Secretary. As our membership grows, so does her work.

To the Secretaries of the State Societies: Send your lists of old and new members, and officers, to the Executive Office promptly. It is only through your officers in the affiliated Societies that your national officers and Board of Directors can function efficiently.

To the Presidents of the State Societies: I would like to request that during the next thirty days each of you as members of the Advisory Council officially select a member to work with the Chairmen of the following committees: Membership, Standards and Studies, and Legislative Committees, especially, and send their names and addresses to the Executive Office. These people will serve as sub-committee men in their respective states under the direction of the Chairmen and other five members of the national committees. As time goes on we may need sub-committees to work with the chairmen of the other five committees. This request will be made of you as the need arises.

Cooperate with the Editor and her staff of our official Journal. Our Journal has made remarkable progress during the past year and congratulations to the editorial staff have been received not only from our own membership, but from our pathologists, editors of other journals, etc. With an increase in membership and a concomitant increase in available funds allowed the Journal, as well as more advertising therein, it has been possible to enlarge the magazine to 72 pages. With the continued co-operation of the state societies in sending copies of the papers read before their conventions, in addition to papers presented at our national meetings, together with interest augmented by the state and national paper writing contests, the scientific value of the Journal has increased to the individual members.

Inserted in this issue you will find a copy of the Constitution and By-laws as amended and passed by the House of Delegates in Denver. Study it carefully so that you may know what has been done and what is to be done. If you are in a state which has no organization, or one which is not now affiliated with the A.S.M.T., plan to take the necessary steps to comply with the revised requirements for membership.

Finally, I wish to thank the officers, the Board of Directors, and the House of Delegates of the fiscal year just past, for their building of such a firm foundation on which to start our work of this year. We have an auspicious beginning with a membership of nearly 3000 (let us make it 5000 by July, 1948). The medical technologists of Minnesota are already making plans for a wonderful convention for next June. Let us all work together for a bigger and better American Society of Medical Technologists.

Sincerely yours,

LUCILLE WALLACE, President

THE BOARD OF DIRECTORS REPORTS

That the attention of the membership be called to the fact that the dues of the American Society of Medical Technologists have been raised from four to five dollars per year, and that the statement for dues payable for this fiscal year (1947-48) will be the last sent from the Executive Office. Hereafter the state (or local) organizations will collect the annual dues for all organizations.

The Editor-in-Chief of the Journal, with the assistance of the Membership Committee, will revise the "Information Pamphlet" to conform with the revision of the Constitution and By-laws. The Membership Committee will devise means of distribution of this third edition in conjunction with the Membership Committee of state and local societies.

The new application blank for membership has been prepared in duplicate, one copy of which shall be retained by the state society secretary, and the other forwarded to the office of the Executive Secretary. In those states which have affiliated local or district organizations, it is suggested that an application blank be prepared to conform with these in order that this may be retained by the local secretary.

The question has been brought up in regard to the awarding of medals for prize-winning papers presented at the annual convention. Do the members feel that the medals might well be discontinued, while the monetary awards could be retained?

The supplementary rosters will continue to be published in the Journal. A list of changes of address will be printed in the January (1948) issue.

A permanent exhibit of the American Society of Medical Technologists shall be prepared and be available for use at state conventions. This will be available through the Executive Office.

Reprints of the article, "A National Sorority for Students of Medical Technology", by Dr. O. T. Walter, which appeared in the March Journal, will be available for distribution to colleges and universities engaged in teaching the subject of medical technology.

The Board of Directors confirmed the request of the local committee in charge of arrangements for the 1948 convention that the location be St. Paul, rather than Minneapolis, Minnesota. The dates will be June 7, 8, and 9, 1948.

CHAIRMEN—STANDING COMMITTEES 1947-48

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7. LEGISLATION:
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   Indianapolis, Indiana

COMMITTEES FOR 1948 CONVENTION

LOCAL ARRANGEMENTS:
Frieda Claussen
469 Laurel Ave.
St. Paul, Minnesota

PROGRAM:
Sister M. Alcuin Arens
College of St. Scholastica
Duluth 2, Minnesota

WHERE ARE THEY?

In early copies of the AMERICAN JOURNAL OF MEDICAL TECHNOLOGY, we find references to the following societies of Medical Technologists: Alabama, Florida, Iowa, Kansas, Missouri, New Jersey, North Carolina, and South Dakota. These have not affiliated with the national society, nor have they had recent reports to the Executive Office nor to the Journal. If they are still organized, they can fulfill the requirements for affiliation with the A.S.M.T. and make unnecessary the organization of a new group in those states. If the secretaries of those societies will report to the Executive Secretary of the A.S.M.T., they will receive instructions concerning the steps to be made toward affiliation.

HAVE YOU CHANGED YOUR ADDRESS LATELY?

In the January, 1948, AMERICAN JOURNAL OF MEDICAL TECHNOLOGY there will be a list of those members who have changed their addresses since January, 1947. In order that your new address may be listed, please be sure to send in your name, with both the old and the new addresses, to Miss Hermine Tate, Executive Secretary, Medical Center Bldg., Lafayette, La. This information must be in the Executive Office before December 10, 1947, in order that it may reach the Journal by the deadline for January copy. If you do not receive your Journal regularly, it may be due to the fact that your latest address is not in the Executive Office. All copies of the AMERICAN JOURNAL OF MEDICAL TECHNOLOGY are sent from that office to the subscribers.

ARMY MEDICAL LIBRARY MICROFILM SERVICE

During the war, the Army Medical Library through its photoduplication services supplied millions of pages of microfilmed medical articles to the armed services and other research agencies. The principal of immediate aid direct to the user, wherever he might be, introduced a new technique to assist medical research.

This service is now generally available for civilian physicians, institutions and research workers on a cost basis. This means direct access to the Library's enormous resources of medical literature.

A fee of fifty cents is charged for filming any periodical article in a single volume, regardless of length. Microfilming from monographs is furnished at fifty cents for fifty pages or fraction thereof. Photostats are also available at a charge of fifty cents per ten pages or fraction thereof. Material filmed is not for reproduction without permission of the copyright owner.

For convenience and to keep bookkeeping costs down, a coupon system has been established. Users may buy any quantity of photoduplication coupons at fifty cents each. Order blanks are available upon request. Checks should be made payable to the treasurer of the United States, and sent to the Army Medical Library, 7th St. and Independence Ave., SW., Washington, 25, D. C.

COMMITTEE ON NOMINATIONS AND ELECTIONS

The Committee on Nominations and Elections would like the cooperation of all members of the A.S.M.T. and the officers of affiliated societies to submit before December 15, 1947, the names and qualifications of persons whom they wish to propose as candidates for the offices to be filled by the House of Delegates at the next annual meeting. The offices to be filled at that time are: president-elect, recording secretary, treasurer (term of office three years), and two members of the Board of Directors (term of office three years). All proposed candidates, from whom the committee will select the slate for election must have been a member in good standing of the society for at least two years. Please send your suggestions as soon as possible in order that our slate may be completed in time to publicize it sufficiently before our next meeting. Address communications to

HENRIETTA M. LYLE, Chairman,
Maple Manor, R.D. #2, Columbia, Pennsylvania

TO THE SECRETARIES OF STATE AND LOCAL SOCIETIES OF MEDICAL TECHNOLOGISTS:

Please send to the Editorial Office of the A.J.M.T. the following information.

1. Date and location of your annual conventions, and other meetings.
2. Names and addresses of the officers of your societies.
3. Accounts of special activities.
4. Copies of your publications with permission for contents to be reprinted in the Journal if suitable.

Deadline for Journal copy is the 15th of the month preceding publication.

LOUISIANA STATE SOCIETY OF MEDICAL TECHNOLOGISTS

The Louisiana State Society of Medical Technologists in co-operation with the American Society of Medical Technologists is sponsoring a four-day seminar at Loyola University, New Orleans, Louisiana September 29th through October 2, 1947. Registered medical technologists from Texas, Florida, Mississippi, Arkansas and Louisiana have been invited to attend.

The program consists of lectures and demonstrations to be given by outstanding medical men of New Orleans, La. on

1. Mycology
2. Hematology

Program Chairmen:

Mycology

Miss Catherine Goetz, M.T. (ASCP)
Biology Dept.
Loyola University
New Orleans, La.

Hematology

Miss Joy Holm, M.T. (ASCP)
Chief Technologist
Charity Hospital
New Orleans, La.

NEW HAMPSHIRE

The New Hampshire Society of Medical Technologists and Clinical Laboratory Technicians held its annual meeting on June 18 and 19, 1947, at Hotel Wentworth-by-the-Sea. This was the tenth anniversary of the organization of the Society and was celebrated by affiliation with the A.S.M.T. Four members were present who attended the 1937 meeting. This was also the first time that a meeting of more than one day has been attempted.

Committees on the Constitution, regional meetings, and publicity were appointed.

"Rh Factor," Dr. John B. Holyoke, Dartmouth Medical School, Hanover, New Hampshire.

Demonstration—Hinton and Mazzini.
A. Frances Lewis, N. H. State Dept. of Health, Concord.
Eleanor E. Hoag, Dartmouth Medical School, Hanover.

Reports on special courses.

Informal dinner.

Movies—"The Atomic Bomb"

Movies—"Malaria and Amoebae," U. S. Public Health Service.

"Intestinal Parasites," Dr. James H. Park, Tufts Medical School, Boston, Mass.

"Recent Advances in Hematology," Dr. William Dameshek, Tufts Medical School, Boston, Mass.

STATE AND LOCAL SOCIETIES

ARKANSAS

Arkansas Society of Medical Technologists (affil. A.S.M.T. #16).
President: Miss Irrovia Corry, St. Vincent's Infirmary, Little Rock, Arkansas.

CALIFORNIA

California Society of Medical Technologists (affil. A.S.M.T. #23) last convention, May, 1947.
President: Jean Lawrence, 1991 Manhattan Ave., Palo Alto.
President-elect: Martha Lee, 14239 Victory Blvd., Van Nuys.
Secretary: Genevieve Walters, 1204 Ozone St., Santa Monica.
Treasurer: Amelia May Clark, 1232 16th St., Santa Monica.

COLORADO

Colorado Society of Medical Technologists (affil. A.S.M.T. # 7) last meeting, June, 1947.
President: Elizabeth O'Toole, 1345 Elati St., Denver.
President-elect: Lavina White, Clinical Laboratories of C. W. Maynard, M.D., Pueblo.
Secretary: Pauline Kurachi, Colorado State Hospital, Pueblo.
Treasurer: Virginia Wier, 1104 Republic Bldg., Denver 2.

DISTRICT OF COLUMBIA

District of Columbia Society of Medical Technologists (affil. A.S.M.T. #9) last election of officers, November, 1946.
President: Mollie Hill, Veterans' Administration Facility, Mt. Alto Hospital, Wisconsin Ave., Washington.
President-elect: Mrs. Grace Wagner, 110 S. Pitt St., Alexandria, Va.
Recording Secretary: Mrs. Evelyn Musgrave, 33 N. Fenwick St., Arlington, Va.
Corresponding Secretary: Mrs. Mary Agnes Comly, 109 Park St., Rockville, Md.
Treasurer: Virginia Crowe, Park Lane Apts. #618, Washington.

GEORGIA

Savannah Society of Medical Technologists (affil. A.S.M.T. #12).
Secretary: Elizabeth E. Paulson, 515 East 41st Street, Savannah.

ILLINOIS

Illinois Society of Clinical Laboratory Technologists (affil. A.S.M.T. #10) last election of officers, May 1947.
President: Cecilia M. Korteum, 1164 N. Dearborn, Chicago 10, Ill.
Vice President: Sr. M. Generosa Rosenkranz, St. Francis Hospital, Peoria.
Secretary: Marian Cody, 508 Main St., Peoria.
Treasurer: Marie McCoy, 2700 West 69th St., Chicago.
Chicago Society of Medical Technologists (affil. A.S.M.T. #4).
President: Ruth Feucht, 6120 Greenwood, Chicago 37.

INDIANA

Indiana Society of Medical Technologists (affil. A.S.M.T. #8). Has not been re-organized since war. Contact—President Rachel M. Lehman, 3939 N. Capitol, Indianapolis.

Indianapolis Society of Medical Technologists (affil. A.S.M.T. #17).
President: Alice Fix, 1431 North Meridian St., Indianapolis 2.
Secretary: Constance Padden, 3630 North Meridian St., Indianapolis 8.

KENTUCKY

Kentucky Society of Medical Technologists (affil. A.S.M.T. #2).
Secretary: Dorothea C. Shepherd, Russell.

LOUISIANA

Louisiana State Society of Medical Technologists (affil. A.S.M.T. #18) last convention, May, 1947.
President: Inez L. Jordan, 2327 Monroe, Alexandria.
President-elect: Hazel Newton, 2639 Napoleon Ave., New Orleans 15.
Secretary: Dorothy Dickinson, P.O. Box 1368, Alexandria.
Treasurer: Rosabel L. Shavin, 3637 Youree Drive, Shreveport.

MASSACHUSETTS

Massachusetts Association of Medical Technologists and Laboratory Technicians (formerly Worcester District, (affil. A.S.M.T #20).
President: Mary Yeaton, 34 Castle St., Worcester.
Secretary: Irene L. Newton, Worcester State Hospital.
Treasurer: Isabelle Lyon, 49 Whitman Road, Worcester.

MARYLAND

Maryland Association of Medical Technologists (not affiliated) reorganized April, 1947.
President: Betsy Schmitz.
Vice President: Mrs. Florence Levin Singer.
Recording Secretary: Miriam Walsoh.
Corresponding Secretary: Mrs. Norma Feik McElvain, 3608 Tenth St., Baltimore. 10
Treasurer: Mrs. Nancy Keener Menzel, 2900 Garrison Blvd., Baltimore 16.

MICHIGAN

Michigan Society of Medical Technologists (affil. A.S.M.T. #21) convention May, 1947.
President: Edna Luneke, 72 Sheldon Ave., Grand Rapids.
Vice President: Marjorie Kenyon, 458 West South St., Kalamazoo 46.
Corresponding Secretary: Mrs. Esther Goodson, 148 Oakes St., S.E. 2, Grand Rapids 3.
Recording Secretary: Gladys Jacob, 212 Garfield St., Bay City.
Treasurer: Helen Psik, Foote Memorial Hospital, Jackson.

MINNESOTA

Minnesota Society of Medical Technologists (affil. A.S.M.T. #5) convention May, 1947.

President: Jane Maghan, St. Luke's Hospital, Duluth.
President-Elect: Barbara Tucker, Northwestern Hospital Lab., Minneapolis 7.
Vice President: Mary J. Buckman, Glen Lake Sanitarium, Oak Terrace.
Secretary: Sr. M. Emerita, St. Gabriel's Hospital, Little Falls.
Treasurer: Donna Keller, 836 Lowry, Medical Arts Bldg., St. Paul.

NEBRASKA

Nebraska Society of Medical Technologists (affil. A.S.M.T. #3) convention April, 1947.

President: Kathryn Forest, 2405 South 10th St., Omaha 8.
President-elect: Ida Blore, 1721 F Street, Lincoln.
Secretary: Selma Anderson, University of Nebraska, College of Dentistry, Lincoln 8.
Treasurer: Inez Roesky, 2241 Larimore, Omaha.

NEW HAMPSHIRE

New Hampshire Society of Medical Technologists and Laboratory Technicians (affil. A.S.M.T. #22) convention May, 1947.

President: Eleanor Hoag, Dartmouth Medical School, Hanover.
Vice President: A. Frances Lewis, 105 Pleasant St., Concord.
Secretary: Annie Clark, Higgins Hospital, Wolfesboro.
Treasurer: Melvin Cooley, 6 Charles Street, Claremont.

NEW YORK

Niagara Frontier Association of Medical Technologists (affil. A.S.M.T. #15) Annual election, June, 1947.

President: Alice Sprague, Buffalo General Hospital, Buffalo.
President-elect: Mary Frances Biniszkiewicz, Deaconess Hospital, Buffalo.
Recording Secretary: Carmella Santomieri, Meyer Memorial Hospital, Buffalo.
Corresponding Secretary: Miriam Russell, Buffalo.
Treasurer: Kay House, Millard Fillmore Hospital, Buffalo.

OHIO

Ohio Society of Medical Technologists (affil. A.S.M.T. #14).

Secretary: Anne B. Maddocks, Ohio State University, 1550 East Broad St., Columbus.

OKLAHOMA

Oklahoma Society of Medical Technologists (affil. A.S.M.T. #6) convention May, 1947.

President: Dorothy Foreman, Tahlequah City Hospital, Tahlequah.
Vice President: Zana Skidmore, 401 West 4th St., Tulsa.
Secretary-Treasurer: Lois Keith, University Hospital, Oklahoma City.
Corresponding Secretary: Mrs. Ethel Savage, 1107 Medical Arts Bldg., Tulsa.

OREGON

Oregon Society of Medical Technologists (affil. A.S.M.T. #25) Organized May, 1947.

President: Mary J. Nix, 114 N.E. 44th, Portland.
Secretary: Agnes Marie Lyman, St. Vincent's Hospital, Portland 10
Treasurer: Mary Barbara Godfrey, Good Samaritan Hospital, Portland 10.

PENNSYLVANIA

Pennsylvania Society of Medical Technologists and Laboratory Technicians (affil. A.S.M.T. #11) Officers elected May, 1947.

President: Eleanor A. Stackhous, Abington Memorial Hospital, Abington.
President-elect: Helen Breen, 425 E. Phil Ellena St., Philadelphia 19.
Corresponding Secretary: Elizabeth M. Heck, 958 North Fifth St., Philadelphia 23.
Recording Secretary: Licia G. Gambescia, 1441 S. 13th St., Philadelphia 47.
Treasurer: Elizabeth A. Kauderer, Municipal Hospital, Camden, New Jersey.

TENNESSEE

Davidson County Society of Medical Technologists (affil. A.S.M.T. #19).

President: Burdette Shepherd, Nashville.
Vice President: Thelma Renfro.
Honorary Vice President: Paul Byrn.
Secretary: June M. Brown, 3515 Granny White Road, Nashville 4.
Treasurer: Annanelle Bland.

TEXAS

Texas Society of Medical Technologists (affil. A.S.M.T. #1) convention April, 1947.

President: Vondell Stewart, St. Joseph's Infirmary, Houston 3.
President-elect: Lucille Harris, Hendrick Memorial Hospital, Abilene.
1st Vice President: Faith Wayne, 3306 Carpenter, Dallas.
2nd Vice President: Estelle Boyd, 406 Lott St., Yoakum.
Secretary: Barbara Bickle, Harris Memorial Hospital, Ft. Worth.
Treasurer: Betty McGrew, 2002 A Whitis, Austin.

VIRGINIA

Virginia Society of Medical Technologists (affil. A.S.M.T. #24) Organized June, 1947.

President: Harriet Howe, Ross Road Westham, Richmond.
Secretary: Lee Nadell, 3015 Woodrow Avenue, Richmond.
Treasurer: Cathleen Carter, 2305 Hanover Ave., Richmond.

WEST VIRGINIA

Charleston Society of Medical Technologists (not affiliated) organized as nucleus for state society.

President: Betty Frances Love, 1812 McClung St., Charleston.
Vice President: Doris Boon, Charleston.
Secretary: Dorothy Crawford, American Viscose Corporation, Nitro.
Treasurer: Dessell Foy, Charleston.

WISCONSIN

Wisconsin Association of Medical Technologists (affil. A.S.M.T. #13).

President: Geraldine Miller, Cedarburg.
President-elect: Dorothy Zoeller, 711 N. 16th St., Milwaukee.
Secretary: Sylvia Anderson, 8020 Harwood Ave., Milwaukee.
Treasurer: Katherine Rupp, Wisconsin General Hospital, Madison.

A.S.M.T. ROSTER—Supplement

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St. Paul 4

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Kleinston Apt. 7
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Holloway, Carolina M
P. O. Box 231
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Oxnam, Dixie A.
Winona Infirmary
Winona

Scales, Frances Ray
Box 30
Starkville

Smith, Clarence Edwin
715 North St.
Jackson 35

Smith, Janie Pearl
Rush Infirmary
Meridian

Tomlinson, Ann L.
603 Catalpa St.
Clarksdale

Waggoner, Mary Edith
Baptist Hospital
Jackson

MISSOURI

Drake, Louise T.
Columbia Professional Bldg.
Columbia

Hara, Mary N.
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Webster Groves 19

Murphy, Audrey M.
5444 Queens Ave.
St. Louis 15

Reid, Betty
110 Dal-Whi-Mo
Sedalia

Smiley, Joan T.
Deaconess Hospital
St. Louis

MONTANA

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715 N. 5th Ave.
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Hageman, Sr. Barbara Clare
St. Patrick's Hospital
Missoula

Hollenback, Margaret M.
Buffalo

Johnson, Edna M.
St. Patrick's Hospital
Missoula

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2123 South 17
Lincoln

Ellison, Jean Mary
2464 Harney No. 16
Omaha 2

Mankowaka, Sr. Mary Francesca
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Oscelo

NEW HAMPSHIRE

Boerner, Nancy Lee
New London Hospital
New London

Dalton, Barbara
Mary Hitchcock Hospital
Hanover

NEW JERSEY

Glickman, Myra R.
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Jersey City 4

Greene, Adele E.
107 West Center St.
Clayton

Weakley, Mary Louise
39 South Munn Ave.
East Orange

NEW MEXICO

Bartlett, Shirley
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Artesia

NEW YORK

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239 Lafayette Ave.
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Cosgrove, Rachel
85 Roosevelt St.
Pearl River

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Cooperstown

Harvey, Jane E. Limb
96 Grove Ave.
Staten Island 2

Keenan, Mary Elizabeth
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Lutz, Helen M.
Jeff. Co.
Brownville

Materiale, Mario J.
1256 Far Rockawny Blvd.
Far Rockaway

Paul, Mary Jo
Buckingham Apts., Apt. #29
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Rachman, Rhoda
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Buffalo 16

Reger, Sr. Catherine Ann
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Elmira

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154 Matthews Street
Binghampton

Saltsman, Mary Alyce
Y. W. C. A.
Troy

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Bath

Wheeler, Ruth
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Buffalo 15

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Lennon, Betty B.
Goldston

NORTH DAKOTA

Fluevog, Nora M.
2-A Belmont Apts.
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Ninth & Thayer
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OHIO

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Fitch, Mary L.
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Hatton, Lucile M.
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Akron 2

Headley, Gerald B.
704 S. Champion Ave.
Columbus 5

Hogan, Caroline L.
940 Chelsea Ave.
Columbus 9

Korsznick, Julia
c/o McKitrick Hospital
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Youngstown 5

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P. O., Box 62
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Michael, Juanita Joyce
923 N. Robinson
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1633 East 10th
Tulsa 5

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Oklahoma City

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Portland 9

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Portland 3

Cook, Ruby
911 S.E. 60th Ave.
Portland 15

Duerst, Marie L.
2238 N.E. 13th Ave.
Portland 12

Huffaker, Odessa W.
314 N.E. 76th Ave.
Portland 16

McDonald, Jessie A.
590 N. 23rd St.
Salem

Merritt, Henrietta Stewart
765 South Liberty
Salem

Ploeger, Ernst O., Jr.
5411 N.E. Flanders
Portland 15

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Riverside 15

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Rivard, Annette C.
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Providence 7

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The Memorial Hospital
Pawtucket

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Laurens County Hospital
Laurens

Schiffley, Harriet Bolger
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Sumter

Sharkey, Dorothy C.
Providence Hospital
Columbus 58

SOUTH DAKOTA

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McKennan Hospital
Sioux Falls

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UTAH

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Ogden

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de la Ferre, Sr. Marie
Bishop de Goesbriand Hospital
Burlington

Laughlin, Alice Margaret
c/o Nurses' Home
Rutland Hospital
Rutland,

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Wauwautosa 13

Brasefield, Nell R.
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Plymouth

Buscaglia, Mary
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Wauwautosa 13

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Grande, Beatrice
2320 N. Lake Drive
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3010 W. Wells St.
Milwaukee 8

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Milwaukee 10

Leicht, Jane E.
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Milwaukee

Marugg, Lena C.
1328 E. Albion
Milwaukee 2

Mooty, John A.
Laboratory

Wood
McCormack, Virginia V.
2338 South 15th Place
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Reed, Mary Jeanne
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Milwaukee 11

Roessler, Janet
Milwaukee 11

Tully, Marion I.
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Wauwatosa 13

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Schmidt, Georgia O.
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Ancon

HAWAII

Kempfer, Victoria
Hawaiian Agricultural Co. Hospital
Phala

Wong, Hong Sin
Box 715
Pala, Maui

FOREIGN

CANADA

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63 Hawthorne Ave.
St. John, N.B.

Spruell, Elizabeth Barbour
164 Chestnut St.
Winnipeg, Manitoba

PUERTO RICO

Morell Carmer M
P. O., Box 272
Guayama

Western Positions

Laboratory Technician—Community Hospital, small town near San Francisco; $265; 40 hour week.

Laboratory Technician—Group of physicians, modern and in excellent standing, own progressive clinic and hospital, agricultural area, Southern California; need assistant technician for complete laboratory procedures; $230, meals.

Laboratory Technician—Small private general hospital, village not far from ocean, 200 miles north of Los Angeles; $300.

Laboratory Technician—Two openings; both in private laboratories with work referred by local physicians, Southern California desert area; excellent connections; $300.

Laboratory Technician—10 man group in prosperous area of Central California; modern building and equipment. All procedures, particular emphasis on blood chemistry. $300 month with advancement.

X-Ray Technician—Group of well-established physicians, active practice, busy inland California city; $250.

Business and Medical Registry

(AGENCY)

ELSIE MILLER, Director

ROOM 231, 553 SO. WESTERN AVE., LOS ANGELES 5, CALIFORNIA

OPPORTUNITIES

Bacteriologist to become associated with department of obstetrics-gynecology, university school of medicine; preferably some one well qualified in general bacteriology and virus work; research project requiring at least two years and involving investigation of etiology of pelvic inflammations; $5,000. MT9-1.

Chief technician, hematology technician and, also, bacteriologist; fairly large hospital having university affiliation; busy department, considerable research; interesting city located in U. S. dependency. MT9-2.

Young man well trained in laboratory work and with sound background in chemistry to head department in laboratories of 18-man group and hospital; department supervised by pathologist, Diplomate of American Board; staff of seven technicians; should have administrative ability and be able to take charge of the purchasing of supplies; town of 35,000, Rocky Mountain state; $375-$400. MT9-3.

Chemist or chemical technician for research appointment, teaching hospital; duties principally research on liver diseases involving use of photo-electric equipment; possibility of part-time arrangement permitting one to continue studies; Middle West. MT9-4.

Technician qualified in x-ray and laboratory work; modern, well equipped hospital of small size located in residential town on coast of California; $350, meals, laundry. MT9-5.

Endocrinologist, pharmacologist, bacteriologist and immunochemist; M.S., D.S., or Ph.D. degrees; advanced degrees unnecessary if experienced extensively in research; research appointments, one of the country's largest companies in the pharmaceutical industry. MT9-6.

Bacteriologist and, also, several technicians, both clinical and x-ray; hospital and clinic having important expansion program; research department; opportunities also for recently trained technicians; salaries for latter commence at $65 weekly—salaries for others depend upon qualifications; West. MT9-7.

Bacteriologist, experienced in research; duties consist of studying air filteration and germicidal problems; research laboratories; middle western university; $3600-$4,000. MT9-8.

Laboratory technician particularly well qualified in blood work; 12-man clinic well established in the South; man preferred; minimum $3600. MT9-9.

Chemist capable of assuming charge of chemical control of manufacturing operations; pharmaceutical company having expansion program; Middle West. MT9-10.

Parasitologist; research group working in malaria chemotherapy; $4200-$5200. MT9-11.

Laboratory technician; modern, well equipped hospital, comfortable living conditions; $300, transportation, living quarters; Africa. MT9-12.

Technician well qualified in bacteriology and able to teach laboratory technique; 200-bed hospital; Middle West; $3600. MT9-13.

Laboratory technician; new, 300-bed hospital operated under American auspicies in industrial section in Poland. MT9-14.

Biochemist for research project; preferably someone well trained in steriod chemistry; department of obstetrics-gynecology, university medical school. MT9-15.

Tissue technician; laboratories of fairly large hospital directed by pathologist on part-time basis; must be able to assume considerable responsibility; $3,000; Pacific Coast. MT9-16.

Clinical Laboratory Technician well trained in bacteriological technique; modern, fully equipped hospital of 300 beds; full-time staff of well qualified specialists; town of 40,000; Pacific Northwest; $250. MT9-17.

Technician for department of histology, embryology and neuroanatomy; must be qualified to take charge under staff direction of technical laboratory including routine H&E staining, special staining, gross specimens, equipment and records; man or woman; university school of medicine. MT9-18.

Chief X-ray and, Also, Chief Laboratory Technician; new hospital now being completed and ready for operation not later than January 1; community non-profit hospital sponsored by large industrial company; one of the fastest growing areas in the Southwest; because of housing project, homes available; salaries, $3000. MT9-19.

Biochemist to take charge of department of chemistry of laboratories engaged in diagnostic clinical pathology for various hospitals and expanding into field of research of medical education; university town; Middle West. MT9-20.

Analytical Chemist; faculty appointment, teaching at advanced level; opportunity for developing research program; rank, salary, dependent upon qualifications; possibility continuing studies toward advanced degree. MT9-21.

Two Biochemists experienced in medical biochemistry to join faculty of university medical school; Ranks: Assistant Professors; salaries: $4000, $4500; East. MT9-22.

Research Associate; university school of medicine; M.S., or Ph.D. degree in bacteriology or chemistry required; West. MT9-23.

Bacteriologist; duties general hospital bacteriology in close cooperation with department of bacteriology, university medical school; Middle West. MT9-24.

X-ray Technician; 22-man clinic considered one of the most successful in the Middle West; staff comprised of practically all Diplomates; university town. MT9-25.

Biochemist for post of assistant or associate professor; university medical school; $4500; East. MT9-26.

Bacteriologist or chemist to supervise clinical laboratories under direction of pathologist, Diplomate; duties include teaching; fairly large hospital located in metropolis of United States dependency; $4000; Ph.D. preferred. MT9-27.

Instructor in Bacteriology; Ph.D. required; $3000. MT9-28.

(In requesting information concerning these appointments, we shall appreciate your mentioning the key numbers.)

M. BURNEICE LARSON

Director, The Medical Bureau

32nd Floor, Palmolive Building **Chicago 11, Illinois**